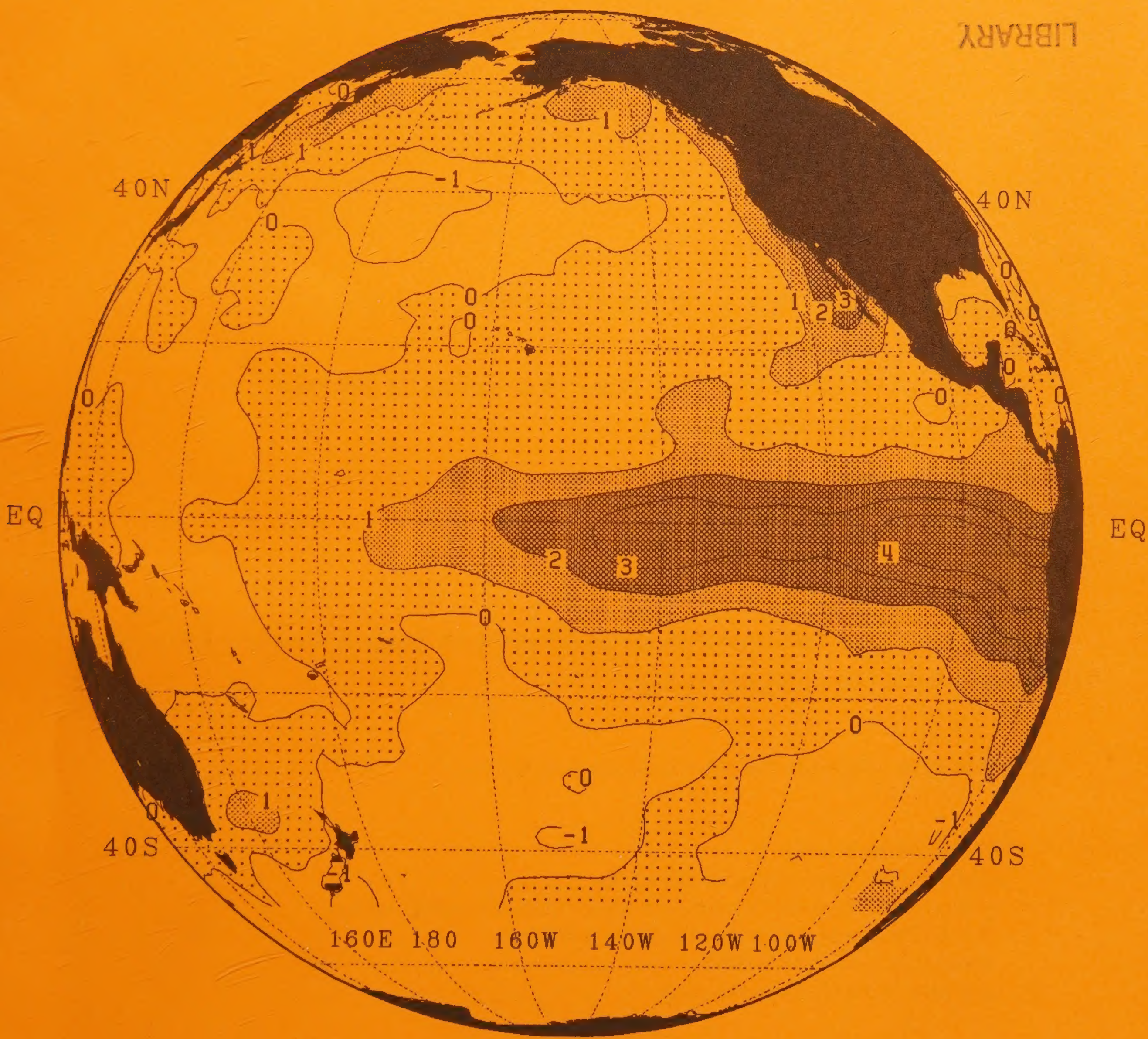
気象庁海洋月報

Monthly Ocean Report

November 1997 (No. 59)



Climate and Marine Department
Japan Meteorological Agency

気象庁 気候・海洋気象部

平成９年１１月

気象庁海洋月報は、気象庁 気候·海洋気象部 海洋課で作成されています。

本月報に関する問い合わせは、

〒100 東京都千代田区大手町 1 - 3 - 4 気象庁 気候·海洋気象部 海洋課まで。

電 話 (03) 3212-8341 (内線 5128、5129)

ＦＡＸ (03) 3211-3047

電子メール ocean@hq.kishou.go.jp

Monthly Ocean Report is prepared by the Oceanographical Division, Climate and Marine Department, Japan Meteorological Agency.

Correspondence relating to this report may be directed to :

Tokunosuke Fujitani
Director, Oceanographical Division
Climate and Marine Department, Japan Meteorological Agency
1-3-4 Ote-machi, Chiyoda-ku, Tokyo 100 Japan
Facsimile: +81-3-3211-3047
e-mail : ocean@hq.kishou.go.jp

表紙は、1997年11月の太平洋の月平均海面水温偏差図です。

陰影部は、平年より高温の海域を示しています。

The figure on the front cover shows the monthly mean SST anomalies for November 1997 in the Pacific Ocean.

Areas of positive anomalies are shaded.

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海況の特徴（１９９７年１１月）

日本近海の海況

海面水温は，北海道の北で平年より1℃以上高かった。本州東方では平年より低く，三陸沖と常磐沖では平年より１℃以上低かった（第4図）。

黒潮は，九州から紀伊半島にかけて接岸した後，東に流れ，八丈島の北を経て房総半島沖に達し，35°N付近を東進していた（第9図）。

本州東方の親潮系の冷水は，沿岸の分枝は39.8°N，143.0°Eまで，沖合の分枝は38.8°N，146.0°Eまで，それぞれ達していた（第5図）。

太平洋の海況

太平洋赤道域の海面水温は，170°W以東で平年より1℃以上高く，110°W以東では+4℃以上の正偏差が見られた。エルニーニョ監視海域（4°N～4°S，150°W～90°W）の海面水温の平年偏差は+3.6℃で，1949年以降最大の値となった（表１）。

北太平洋の海面水温は，40°N付近の負偏差域は先月より狭まり，170°Eから165°Wにかけて-1℃以下の領域が見られるのみとなった。50°N以北および北米沿岸では平年より0.5℃以上高く，カムチャツカ半島からベーリング海にかけてと，アラスカ湾からカリフォルニア半島沖にかけて，+1℃以上の正偏差が見られた（第16図）。

Highlights November 1997

Seas adjacent to Japan

Positive SST anomalies exceeding +1°C were observed north of Hokkaido. SSTs were below normal east of Honshu, and negative SST anomalies exceeding -1°C were observed off Sanriku and off Joban (Fig. 4).

The Kuroshio flowed along the coasts from Kyushu to Kii Peninsula. After passing north of Hachijo Island, it flowed eastward along 35°N off Boso Peninsula (Fig. 9).

Coastal and off-coastal branches of the Oyashio cold water extended southward to 39.8°N, 143.0°E and 38.8°N, 146.0°E, respectively (Fig. 5).

Pacific Ocean

In the equatorial Pacific, SSTs were more than 1°C above normal east of 170°W, and positive SST anomalies greater than +4°C were observed east of 110°W. The SST anomaly of El Niño monitoring region (4°N-4°S, 150°W-90°W) was +3.6°C. This is the largest positive anomaly observed since 1949 (Table 1).

In the North Pacific, SSTs along 40°N became normal except the region from 170°E to 165°W where negative SST anomalies were exceeding -1°C. SSTs more than 0.5°C above normal were found north of 50°N and along the North American coast. Positive SST anomalies exceeding +1°C were found from off Kamchatka Peninsula to the Bering Sea and from the Gulf of Alaska to off Baja California (Fig.16).

黒潮の流量変動

Volume transport variation of the Kuroshio south and southwest of Japan.

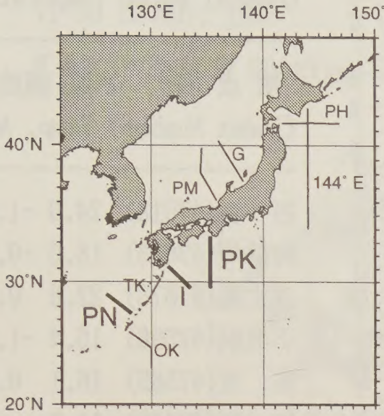


図 A. 海洋気象台の観測船による定期海洋観測定線

Fig. A. Routine oceanographic observation lines in the seas adjacent to Japan.

黒潮は, 亜熱帯循環系の西岸境界流として, 大量の熱と海水を低緯度から中・高緯度に輸送しており, その変動は気候変動に重要な役割を果たしている。

気象庁の各海洋気象台では, 海洋気象観測船によって長期にわたり黒潮を横切る複数の観測線で海洋観測を実施している (図 A)。これまでの観測によって, 四季毎の数十年にわたる黒潮の流量の変動が得られている (図 B)。黒潮の流量は, 本州南方 (PK) においては平均で $45.7 \times 10^6 m^3/s$, 東シナ海 (PN) では平均で $24.1 \times 10^6 m^3/s$ である。本州南方の PK 線においては十年規模の変動が明瞭に見られる。

The Kuroshio, which is the western boundary current of the subtropical gyre in the western North Pacific, transports large volume of heat and mass from low latitudes to middle/high latitudes. The variations of the transports play a significant role in the climate changes.

The Japan Meteorological Agency has performed routine oceanographic observations along fixed lines in the seas adjacent to Japan. Some of these lines run across the Kuroshio. The variations of the Kuroshio volume transport are shown in Figure B. The mean volume transport of the Kuroshio is $45.7 \times 10^6 m^3/s$ south of Honshu (PK) and $24.1 \times 10^6 m^3/s$ in the East China Sea (PN). Decadal variation is obviously found at the PK section.

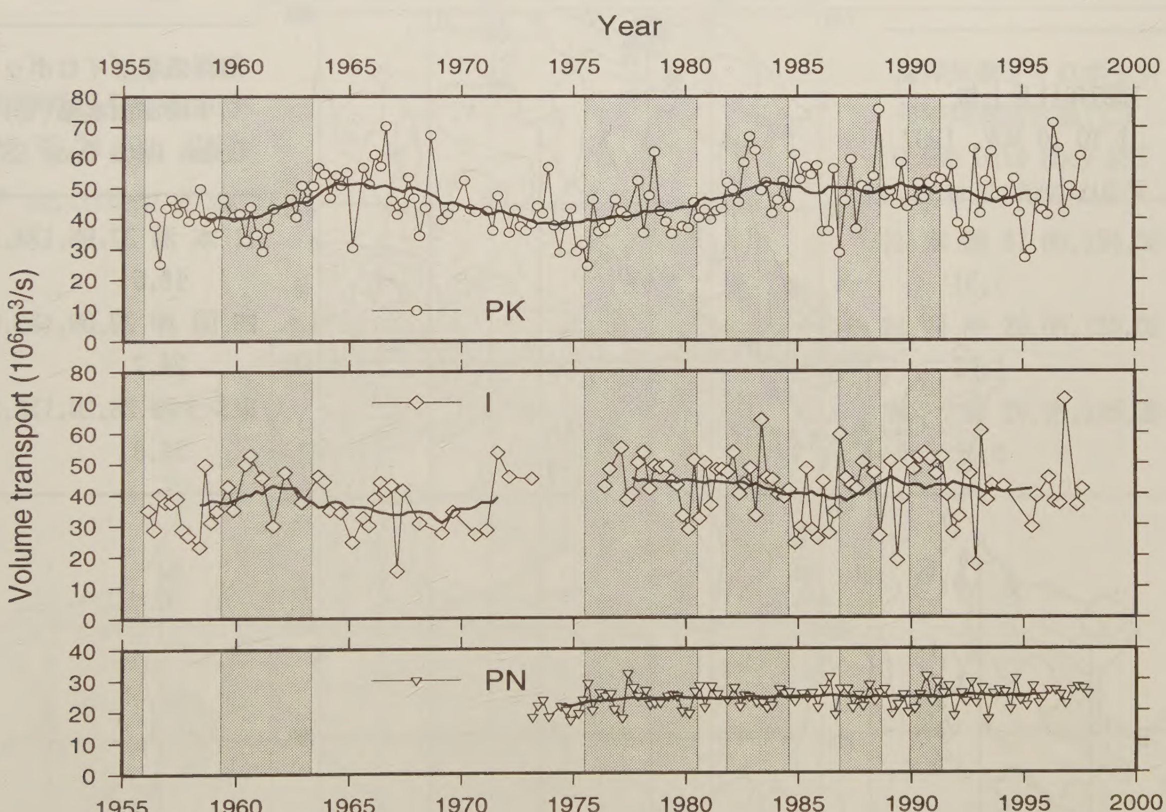
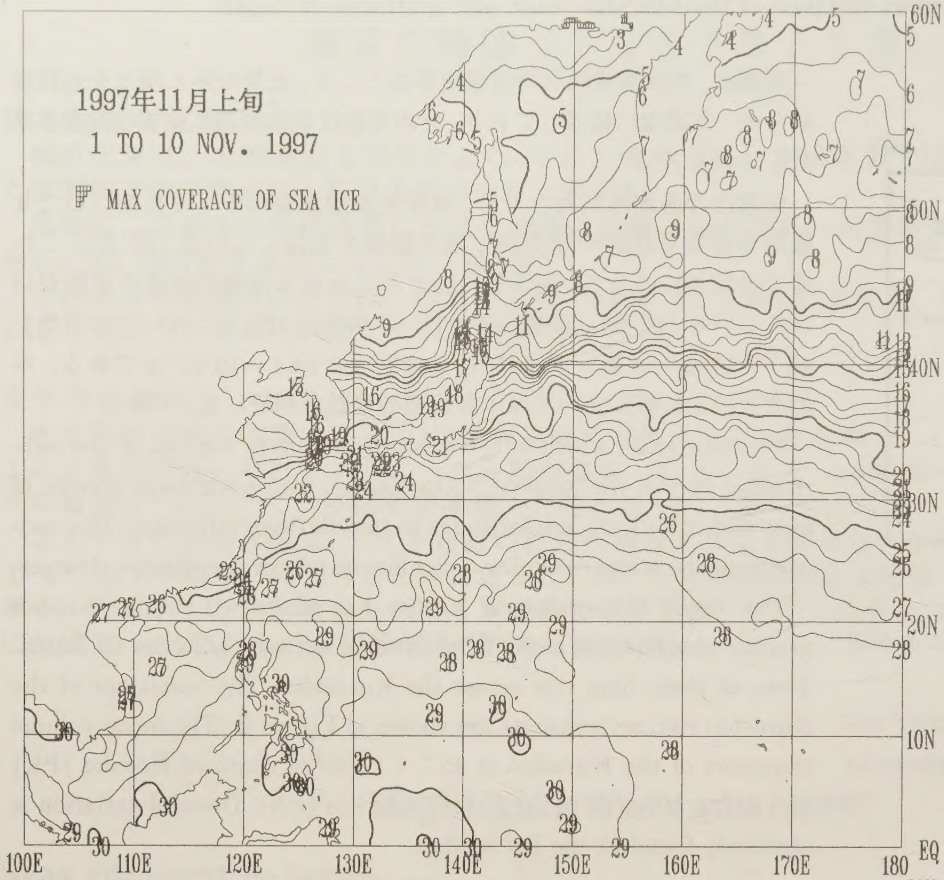


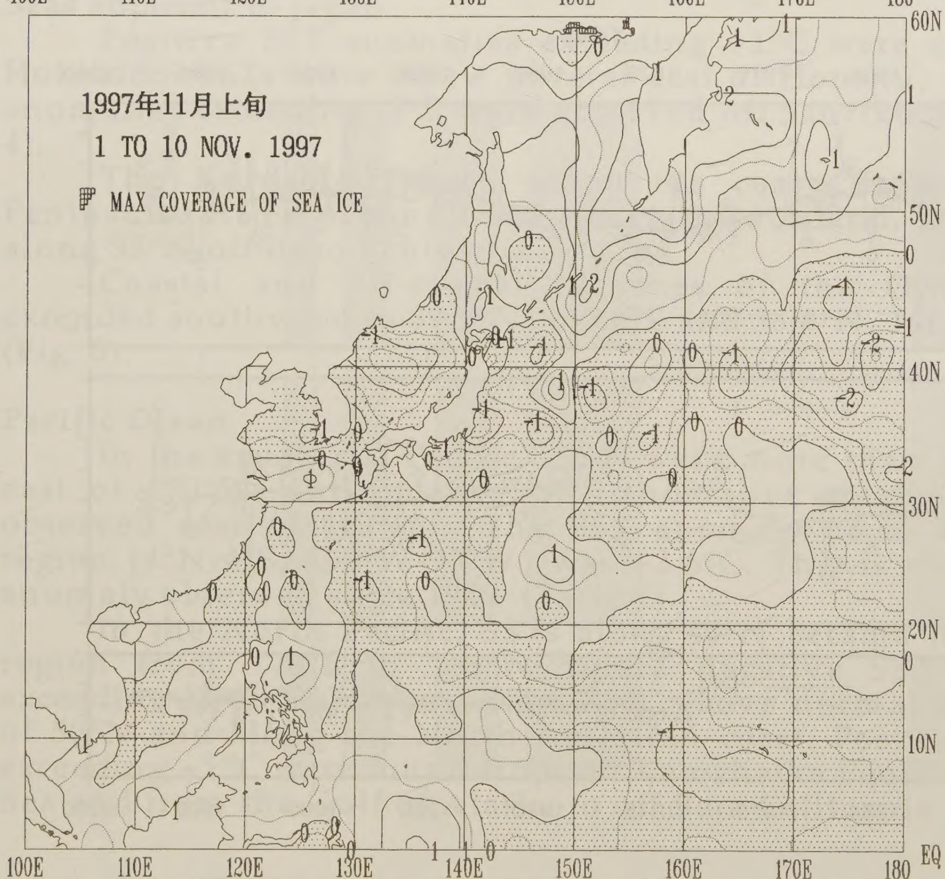
図 B. PK(上), I(中), PN(下) の各定線における観測毎の地衡流量 (細線) とその 5 年移動平均 (太線). (無流面は 1000×10^4Pa [PK, I]/700×10^4Pa [PN]) 本州南方で黒潮大蛇行が発生していた時期を陰影域で示す.

Fig. B. Volume transport of the Kuroshio across the sections PK (top), I (middle) and PN (bottom). Thin lines with marks show the geostrophic volume transport referred to 1000×10^4Pa (PK and I) and referred to 700×10^4Pa (PN) and thick lines show the 5-year running mean of the transport. The periods of the large meander of Kuroshio are shaded.



旬平均沿岸水温(℃)
Coastal Water Temperature

地点名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	24.0	-1.0
御前崎(47655)	18.0	-0.9
八丈島(47678)	22.8	0.1
小名浜(47598)	16.4	-1.1
宮　古(47585)	16.1	0.3
江　差(47428)	14.7	-
浜　田(47755)	18.2	-

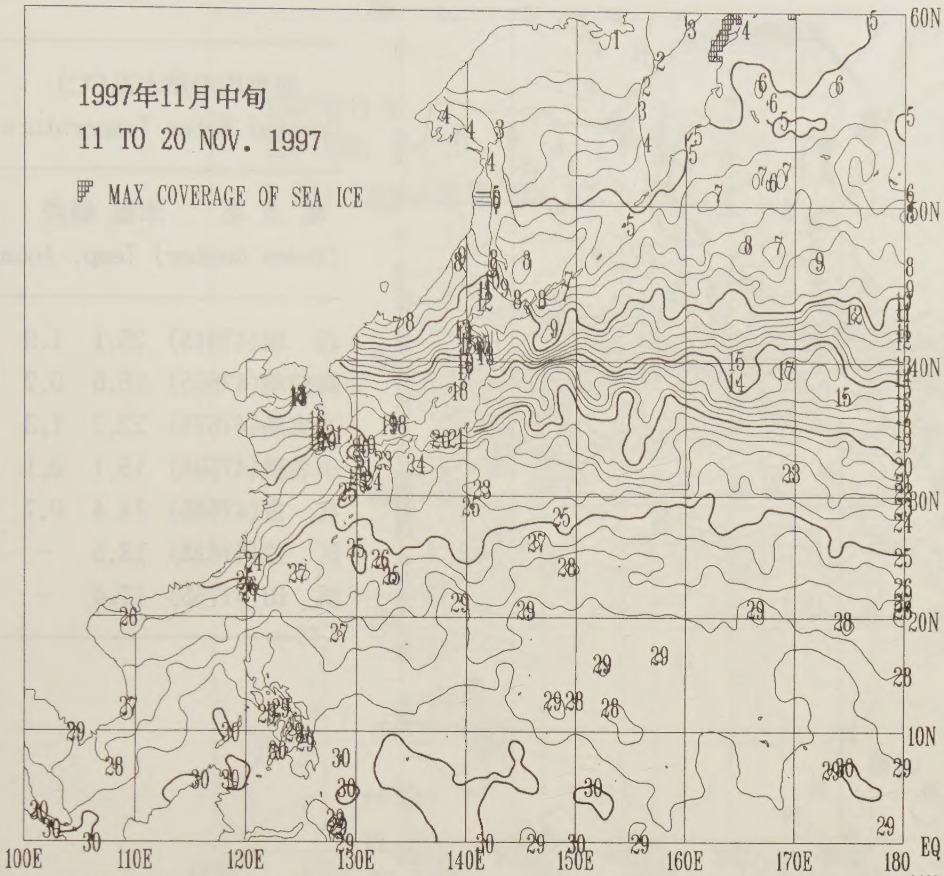


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海	37.9N,134.5E	18.6
四国沖	29.0N,135.0E	24.7
東シナ海	28.2N,126.3E	24.8

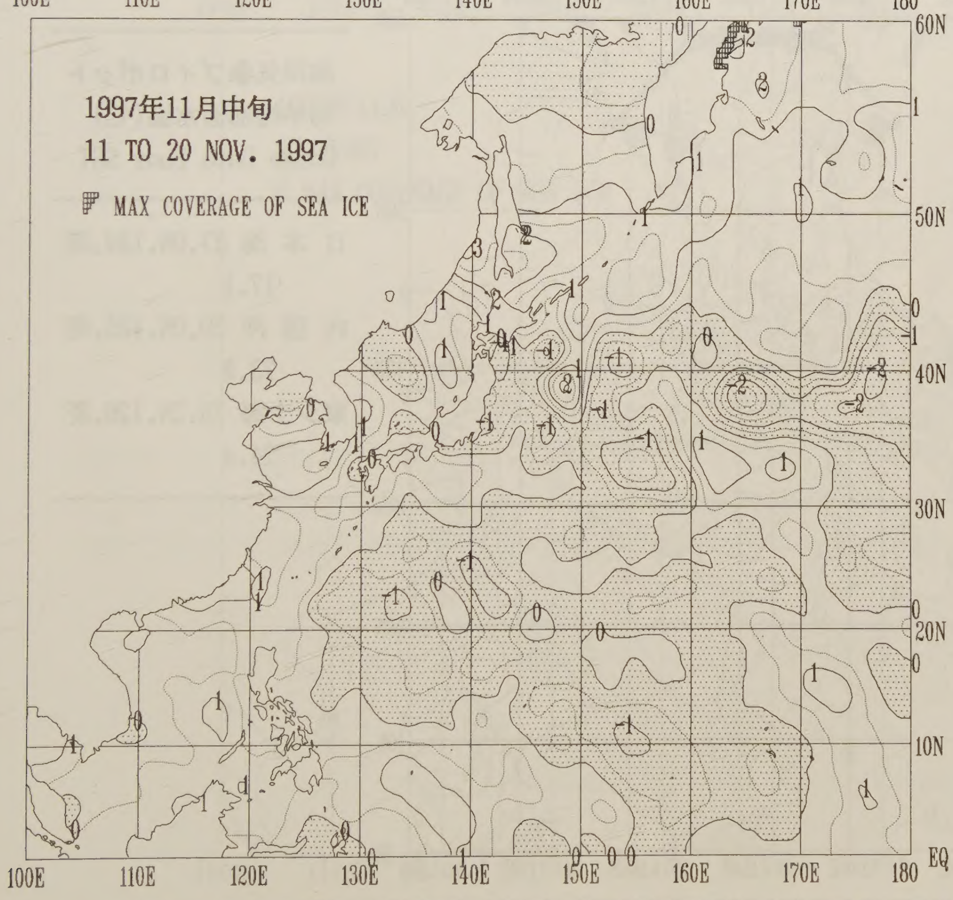
第1図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1997年11月上旬)

Fig.1 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 1st ten-day period in NOV 1997. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



旬平均沿岸水温(℃)
Coastal Water Temperature

地 点 名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	25.2	0.9
御前崎(47655)	18.3	1.0
八丈島(47678)	22.4	0.6
小名浜(47598)	15.3	-0.9
宮　古(47585)	15.1	0.2
江　差(47428)	14.2	-
浜　田(47755)	18.5	-

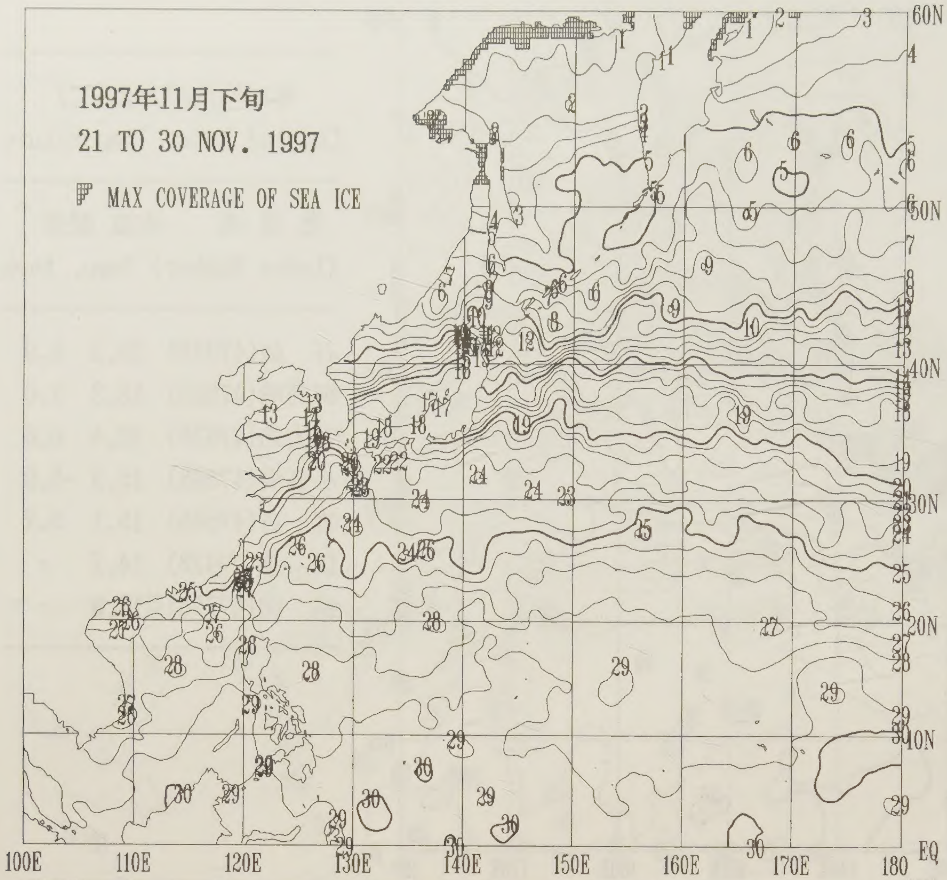


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日 本 海 37.9N,134.5E	18.1
四 国 沖 29.0N,135.0E	24.3
東シナ海 28.2N,126.3E	25.0

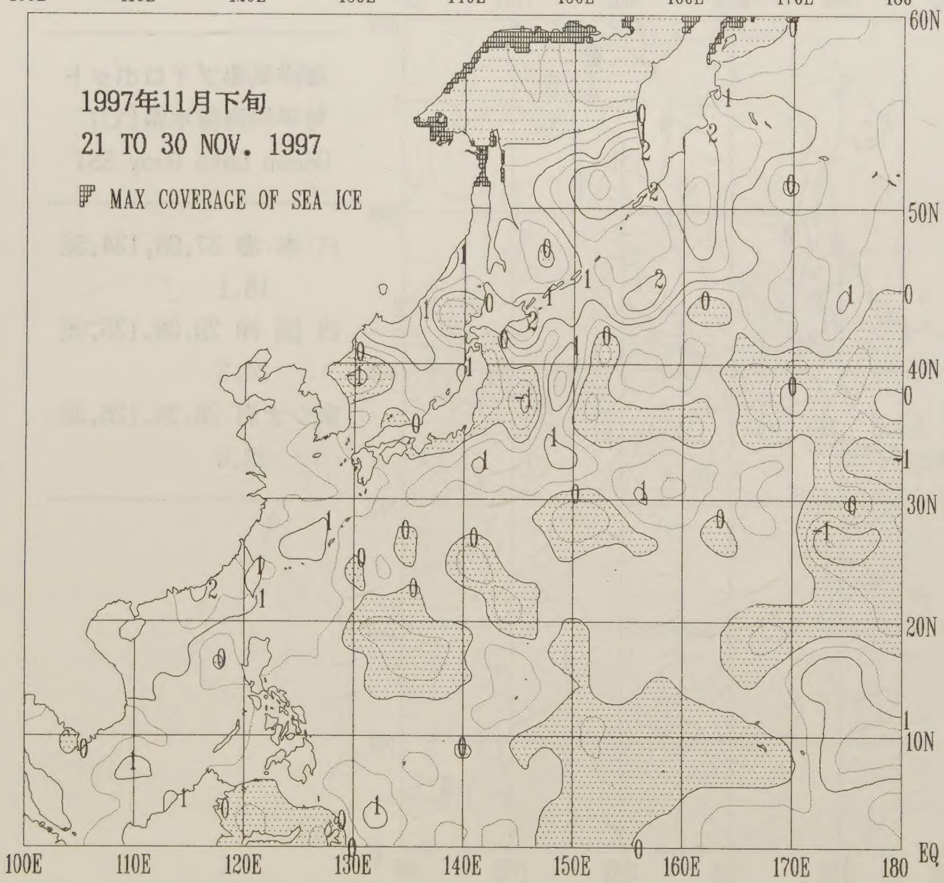
第2図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1997年11月中旬)

Fig.2 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 2nd ten-day period in NOV 1997. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



旬平均沿岸水温(℃)
Coastal Water Temperature

地点名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	25.1	1.9
御前崎(47655)	16.6	0.7
八丈島(47678)	22.2	1.3
小名浜(47598)	15.1	0.1
宮　古(47585)	14.4	0.7
江　差(47428)	13.5	-
浜　田(47755)	17.4	-

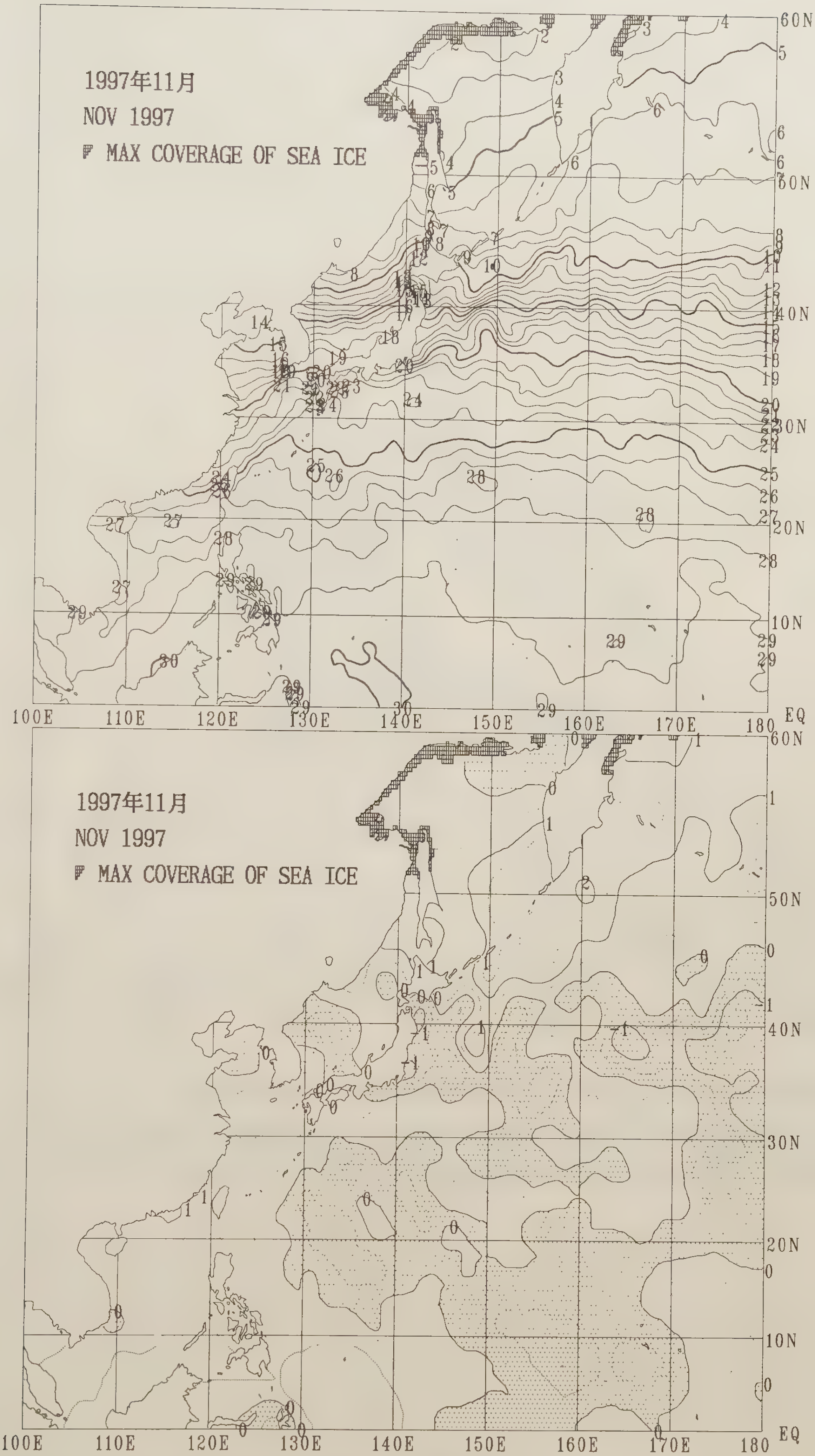


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日本海 37.9N,134.5E	17.1
四国沖 29.0N,135.0E	23.8
東シナ海 28.2N,126.3E	24.4

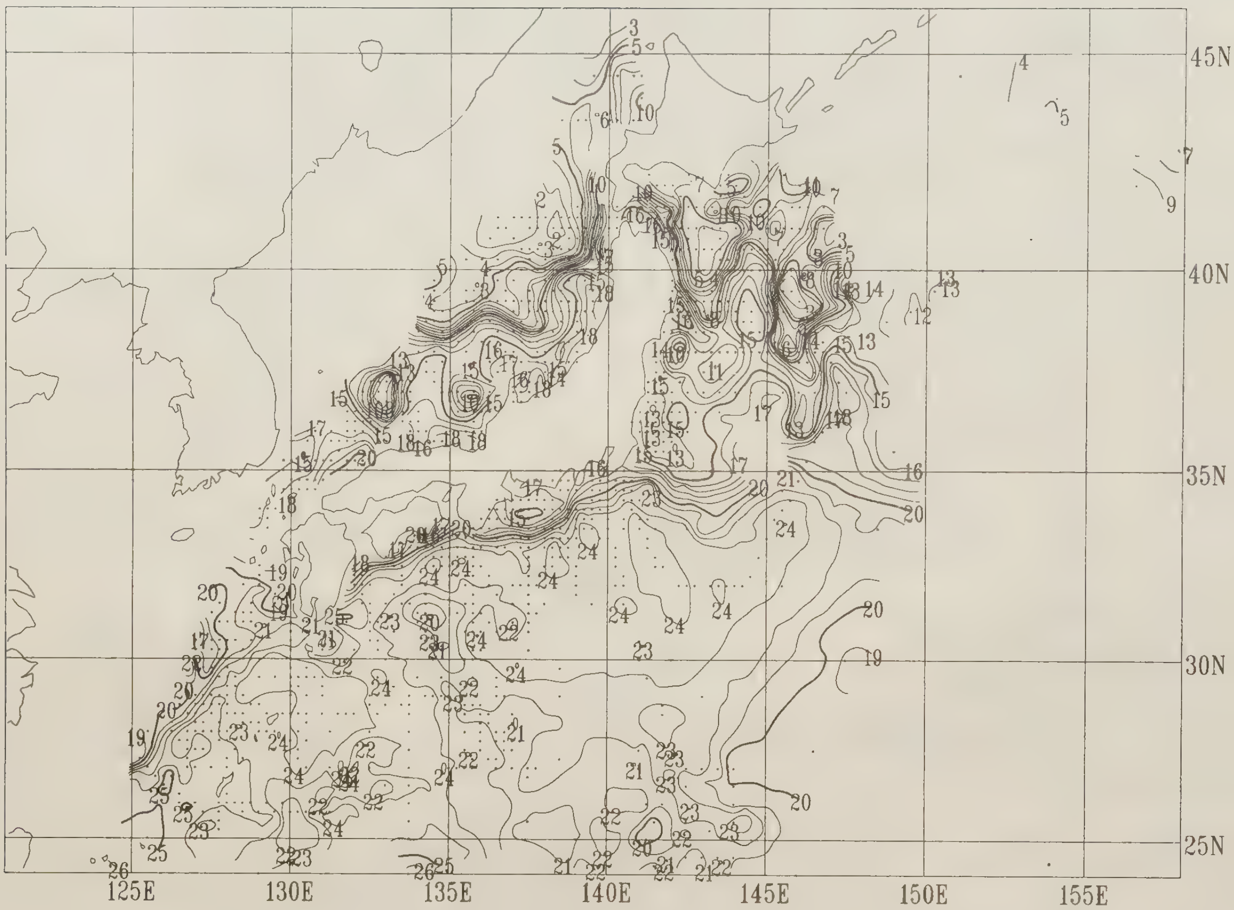
第3図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1997年11月下旬)

Fig.3 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 3rd ten-day period in NOV 1997. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



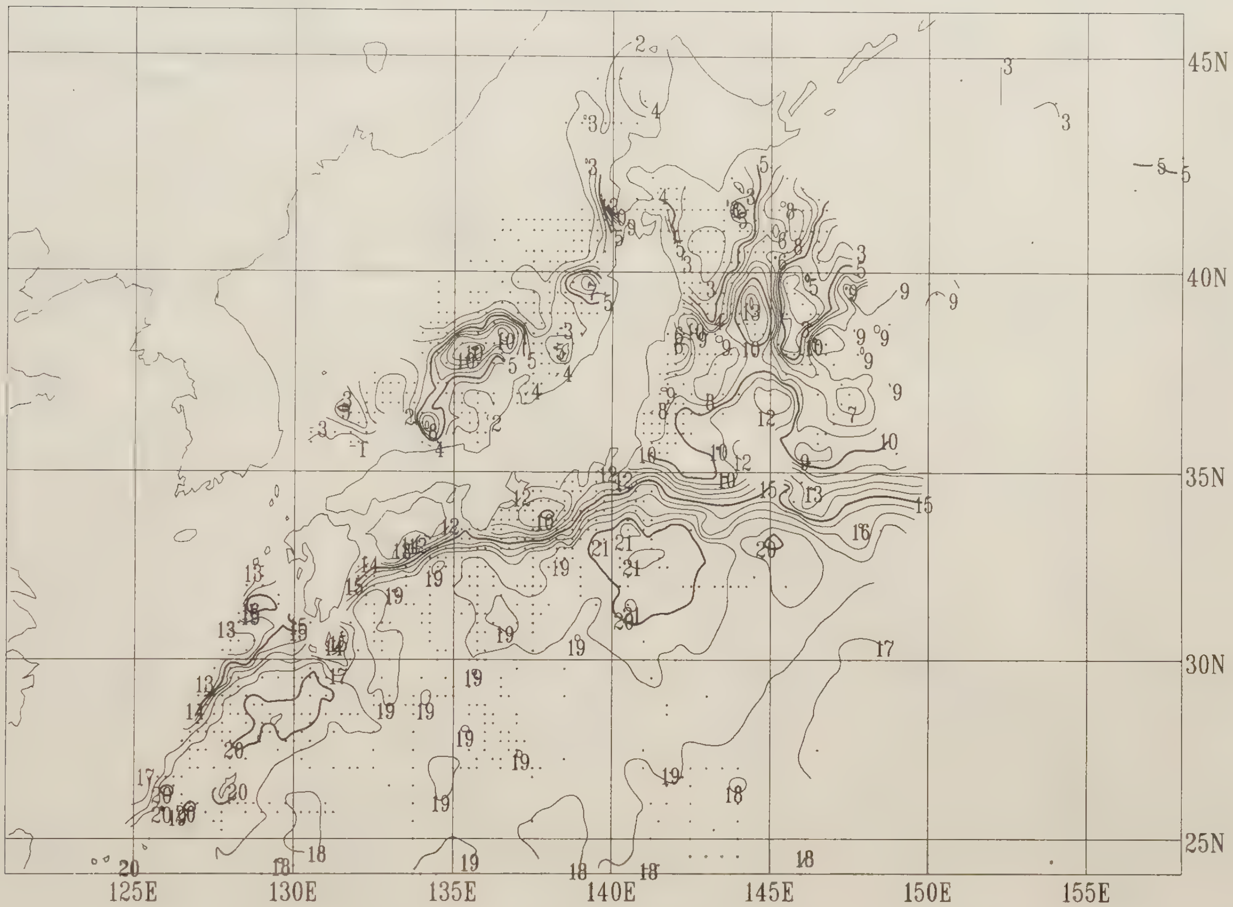
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Fig.4 Monthly mean SST (top) and anomalies (bottom) in the western North Pacific for NOV 1997. Anomalies are computed from the JMA climatology (1961-1990). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



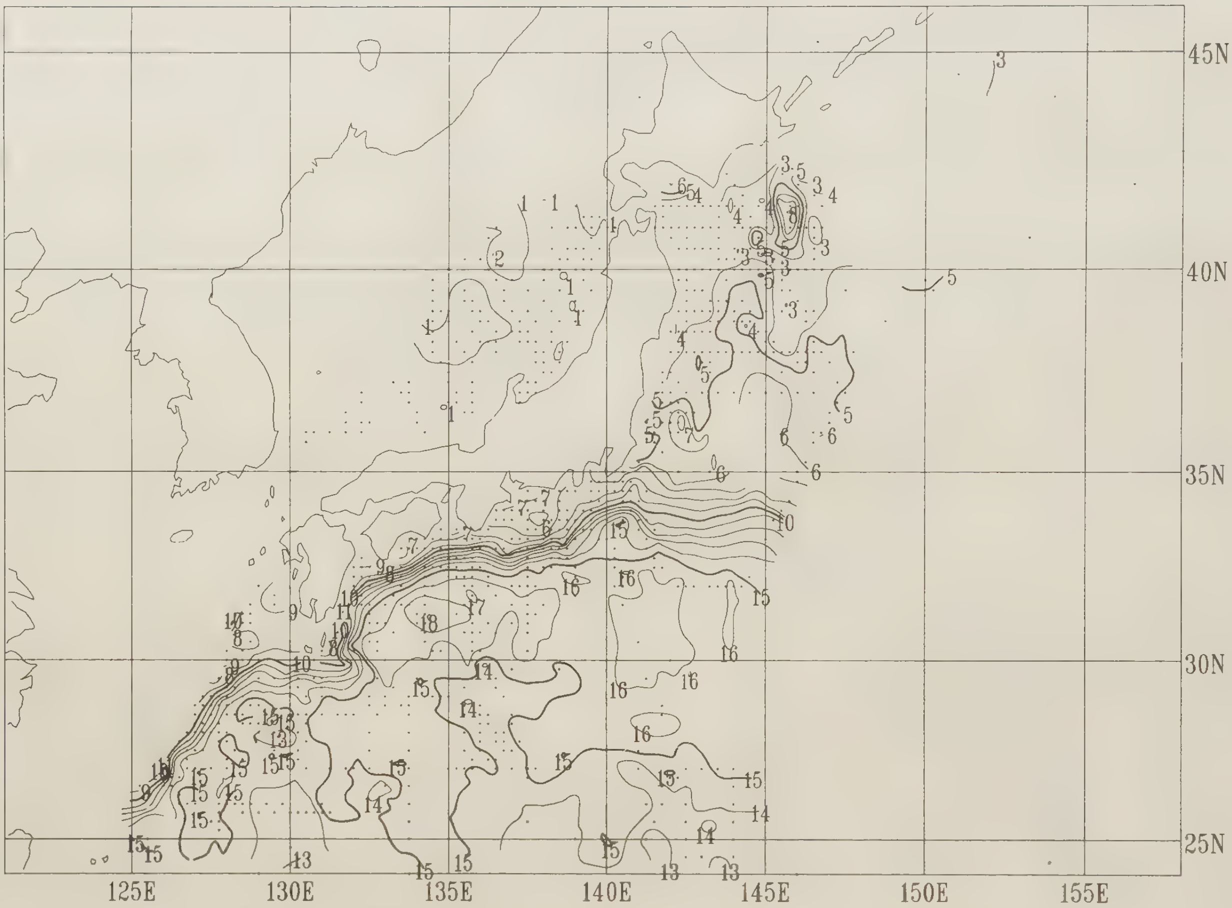
第5図　日本近海表層水温図(深さ100m)(1997年11月)

Fig.5 Subsurface (100m) temperatures in the seas adjacent to Japan for NOV 1997. Contour interval is 1°C. Observation points are denoted by dots.



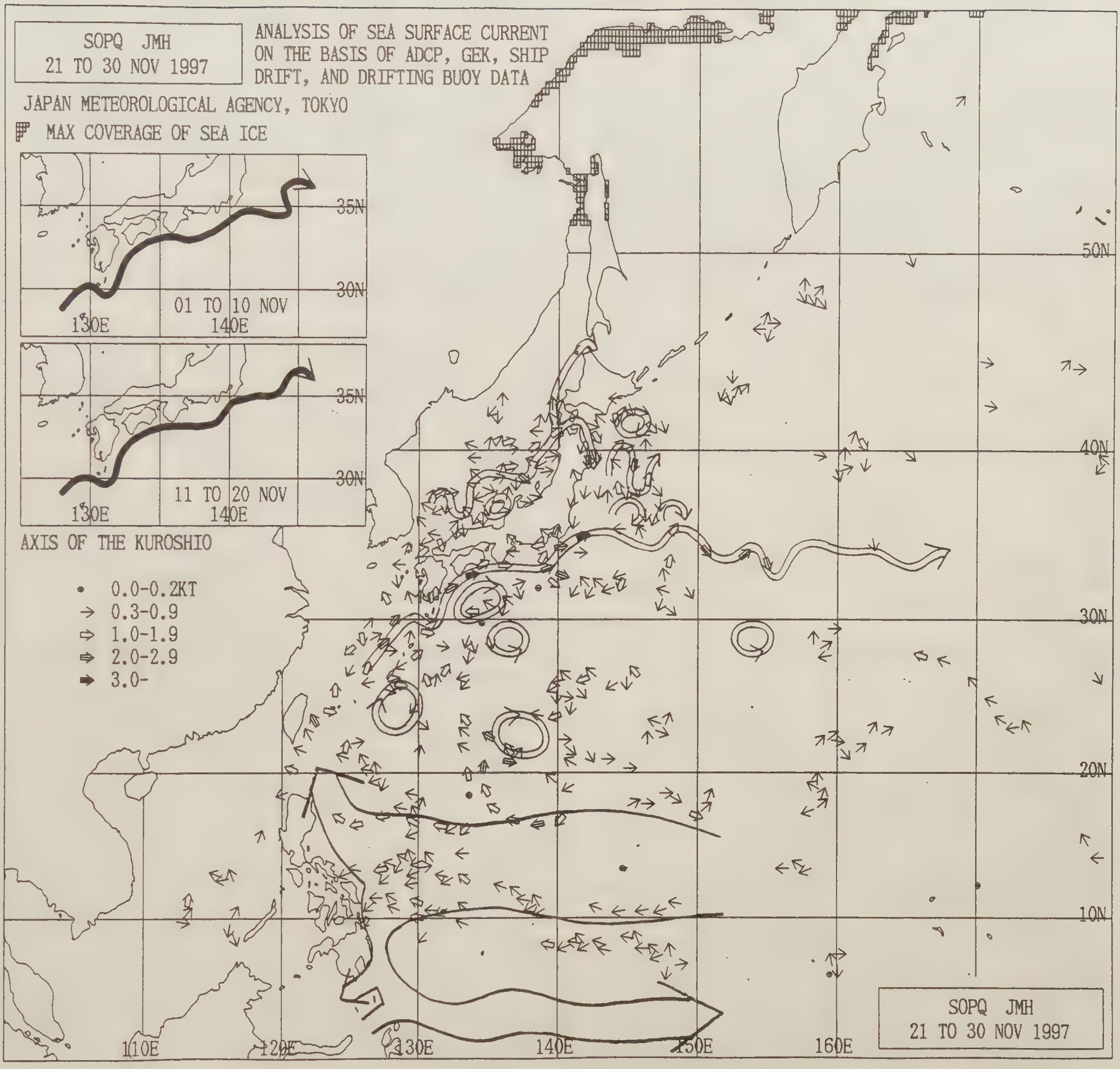
第6図　日本近海表層水温図(深さ200m)（1997年11月）

Fig.6 Subsurface (200m) temperatures in the seas adjacent to Japan for NOV 1997. Contour interval is 1°C. Observation points are denoted by dots.



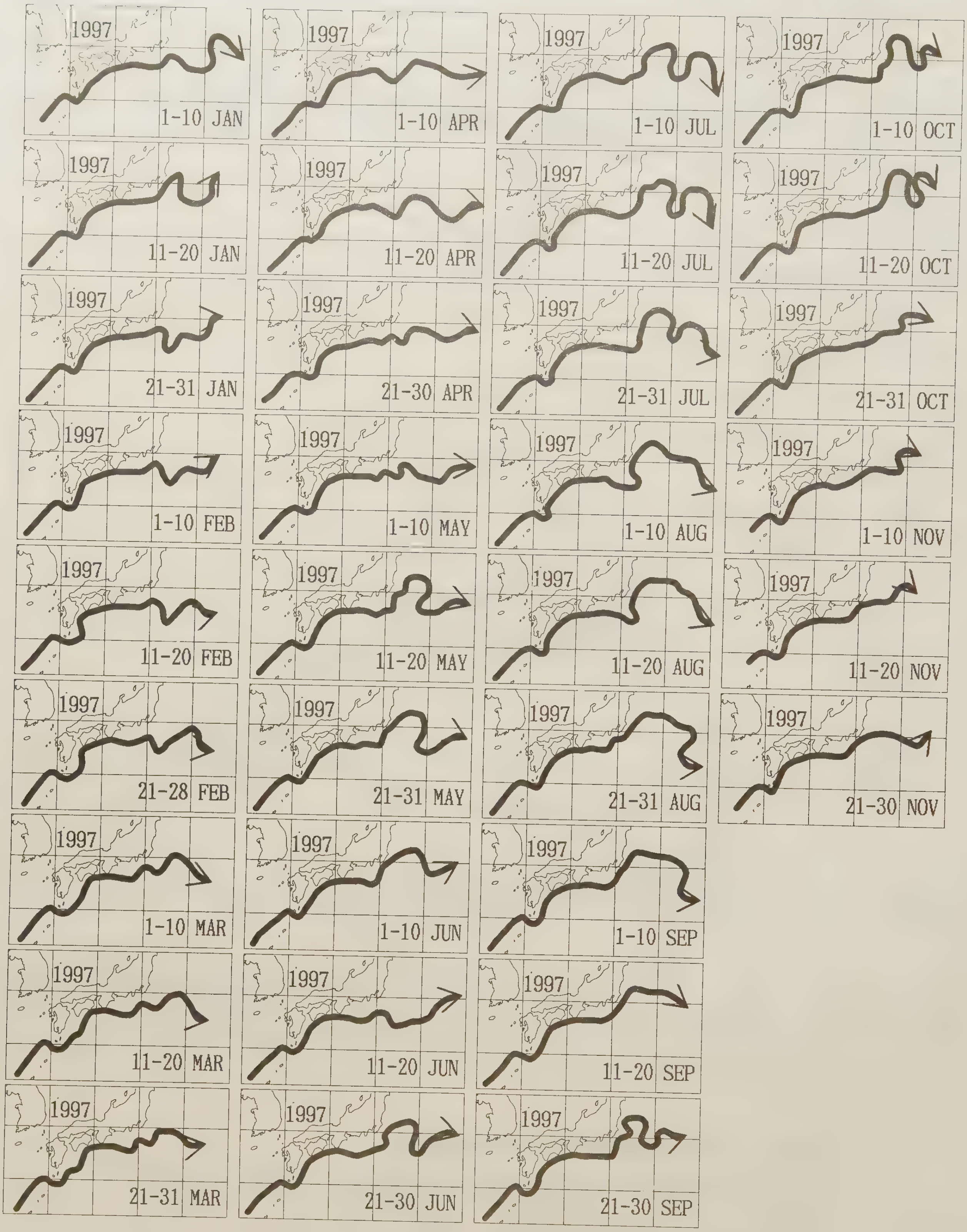
第7図　日本近海表層水温図(深さ400m) (1997年11月)

Fig.7 Subsurface (400m) temperatures in the seas adjacent to Japan for NOV 1997. Contour interval is 1°C. Observation points are denoted by dots.



第8図　北西太平洋海流図（1997年11月下旬）

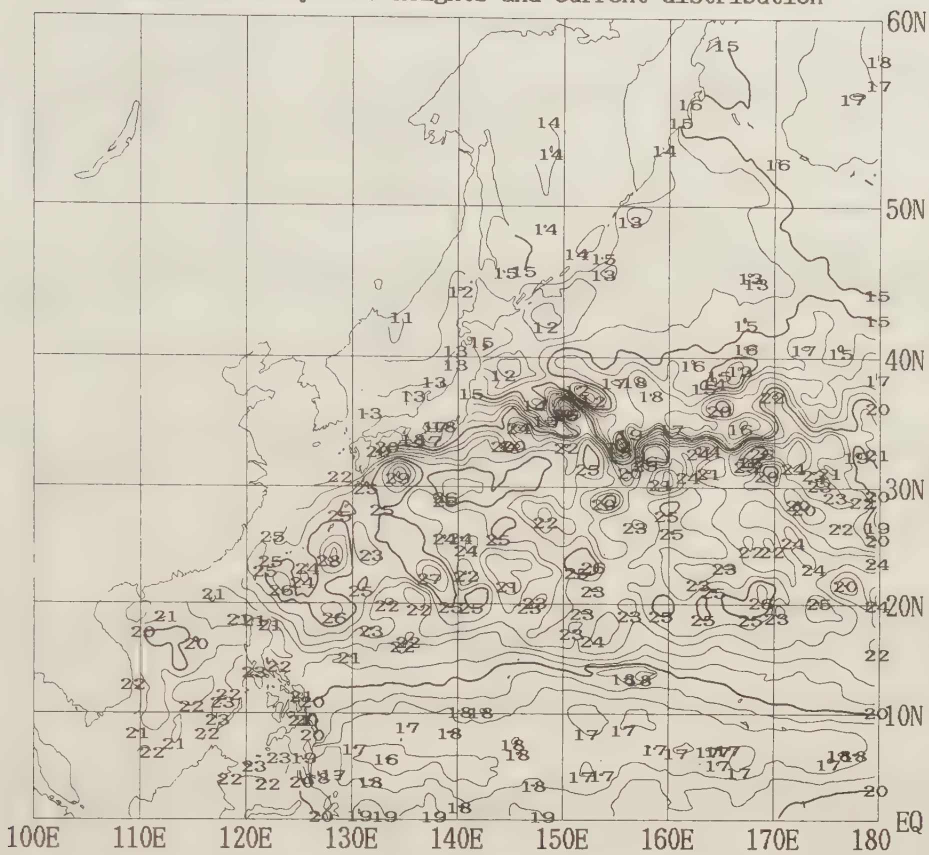
Fig.8 Analysis of the sea surface current in the western North Pacific for the 3rd ten-day period in NOV 1997. Small arrows indicate in situ observations. Major currents such as the Kuroshio and the North Equatorial Current are denoted by larger open arrows.



第9図 旬別黒潮流軸図

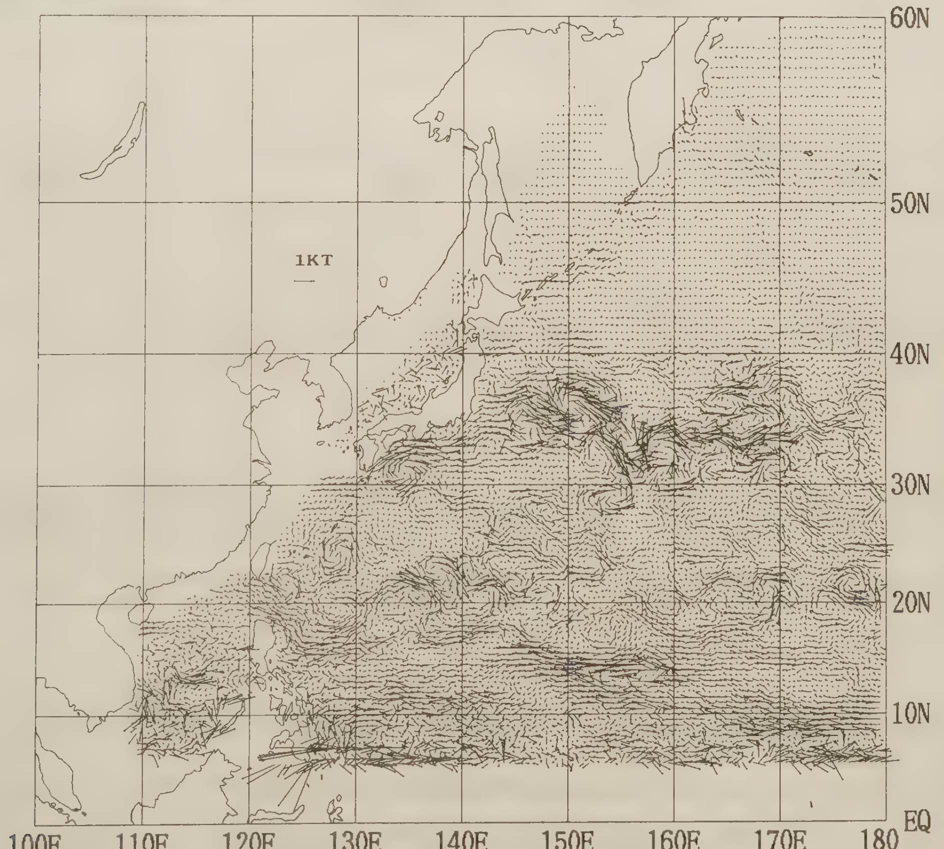
Fig.9 Location of the Kuroshio axis

Sea surface dynamic heights and current distribution



第10図 北西太平洋力学的海面高度分布図(1997年11月7日)

Fig.10 Sea surface dynamic heights (10cm) in the western North Pacific derived from the altimeter data of TOPEX/POSEIDON (NOV 7, 1997).
1500db surface is assumed to be the surface of no motion.

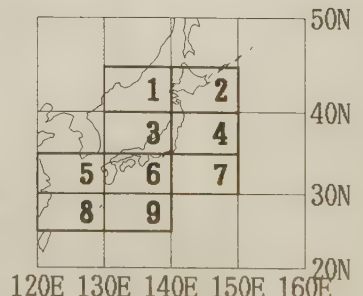


第11図 北西太平洋海流ベクトル図(1997年11月7日)

Fig.11 Sea surface current vectors in the western North Pacific (NOV 7, 1997).
Vectors are derived from the sea surface dynamic heights from TOPEX/POSEIDON and subsurface temperature distribution assuming the geostrophic relation.

Time Series of Area Mean SST in the Western North Pacific

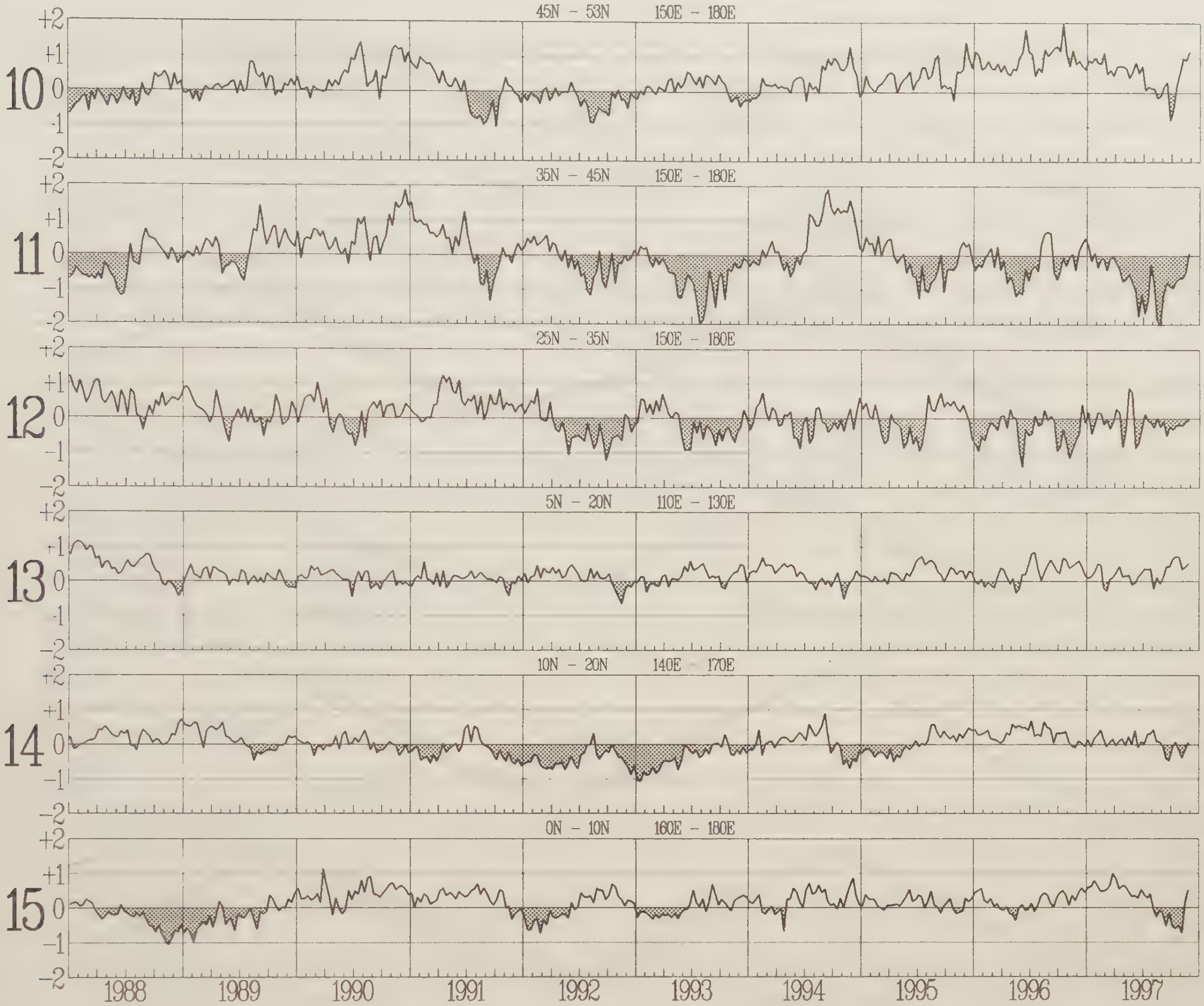




第12図　海域別旬平均海面水温平年偏差時系列図

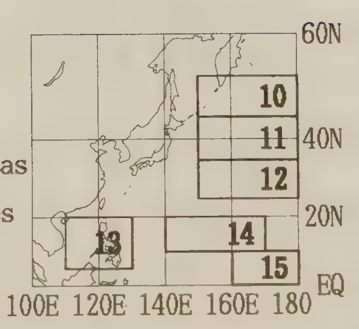
Fig.12 Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right panel. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).

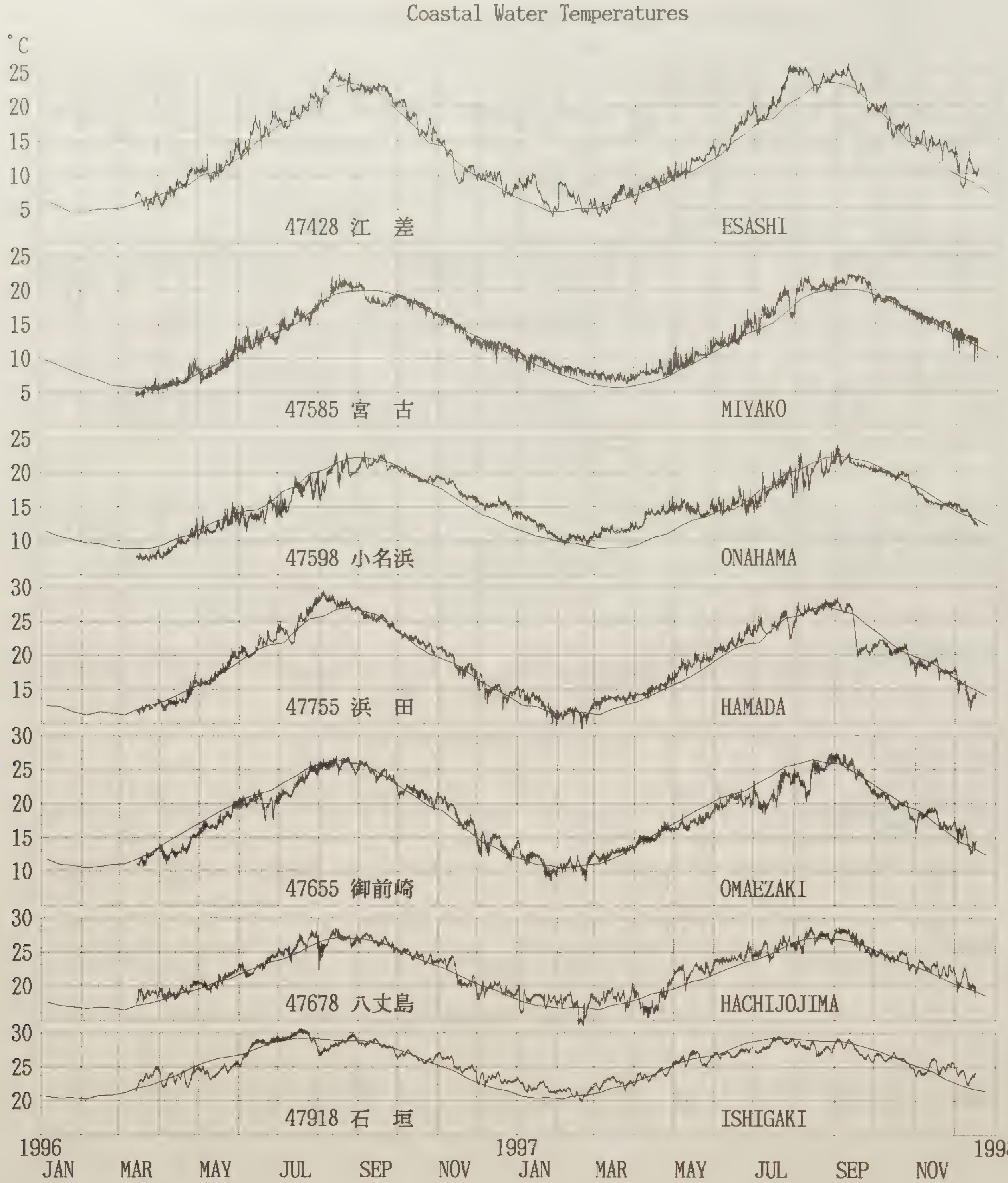
Time Series of Area Mean SST in the Western North Pacific



第12図　海域別旬平均海面水温平年偏差時系列図（つづき）

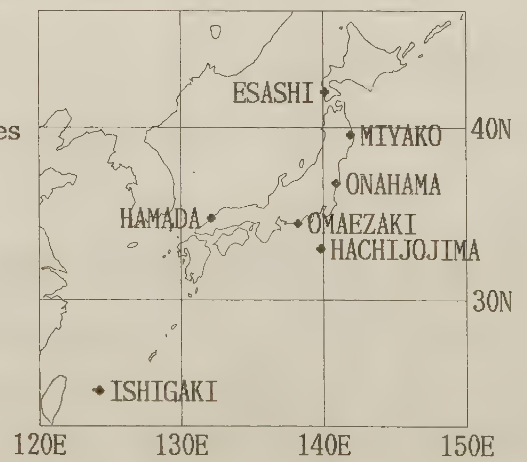
Fig.12 (continue) Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right panel. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).

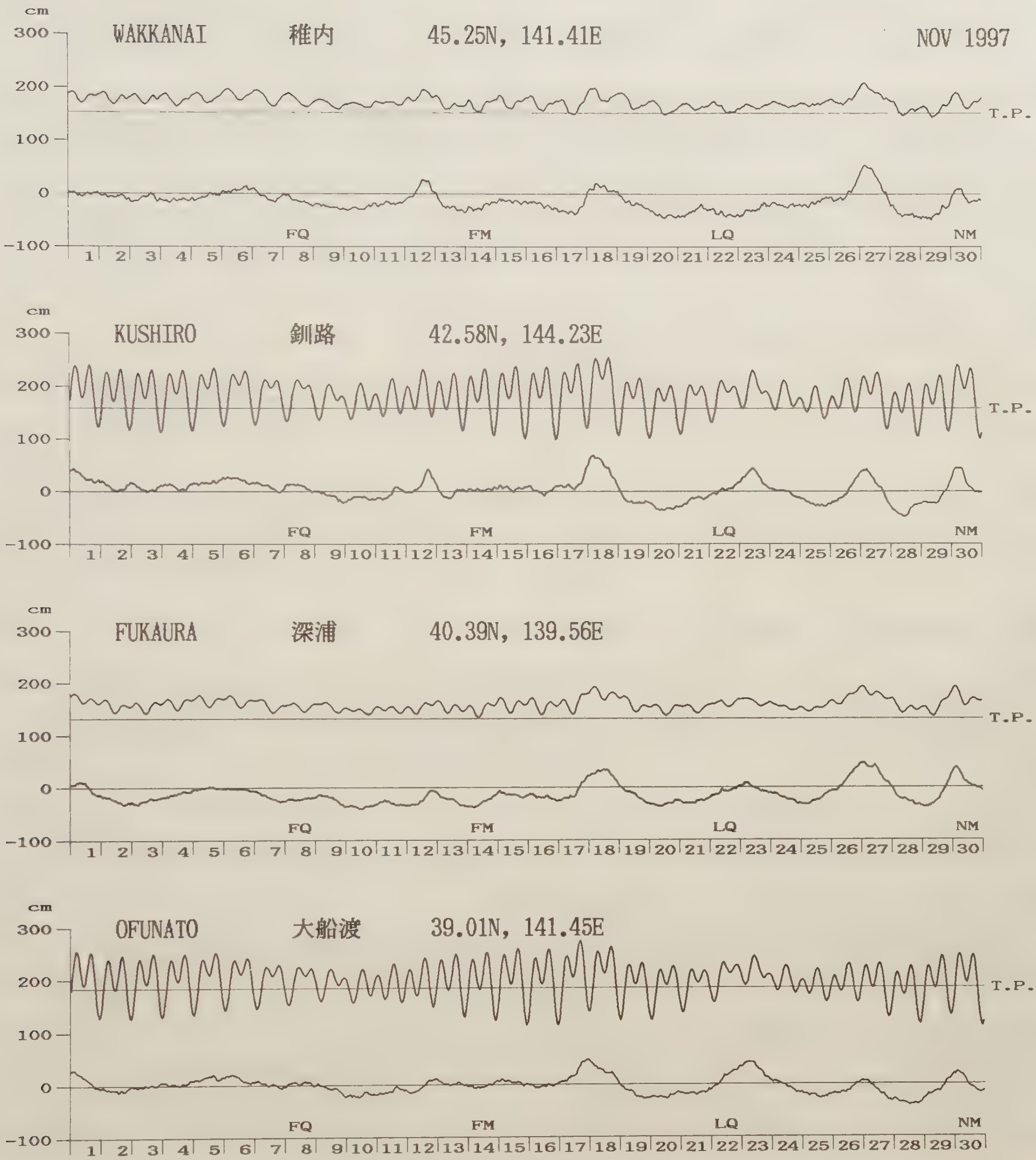




第13図 沿岸水温時系列図

Fig.13 Time series of hourly coastal water temperatures (°C) measured at 7 coastal stations of the JMA shown in the right panel.
Thin lines show ten-day mean climatology.

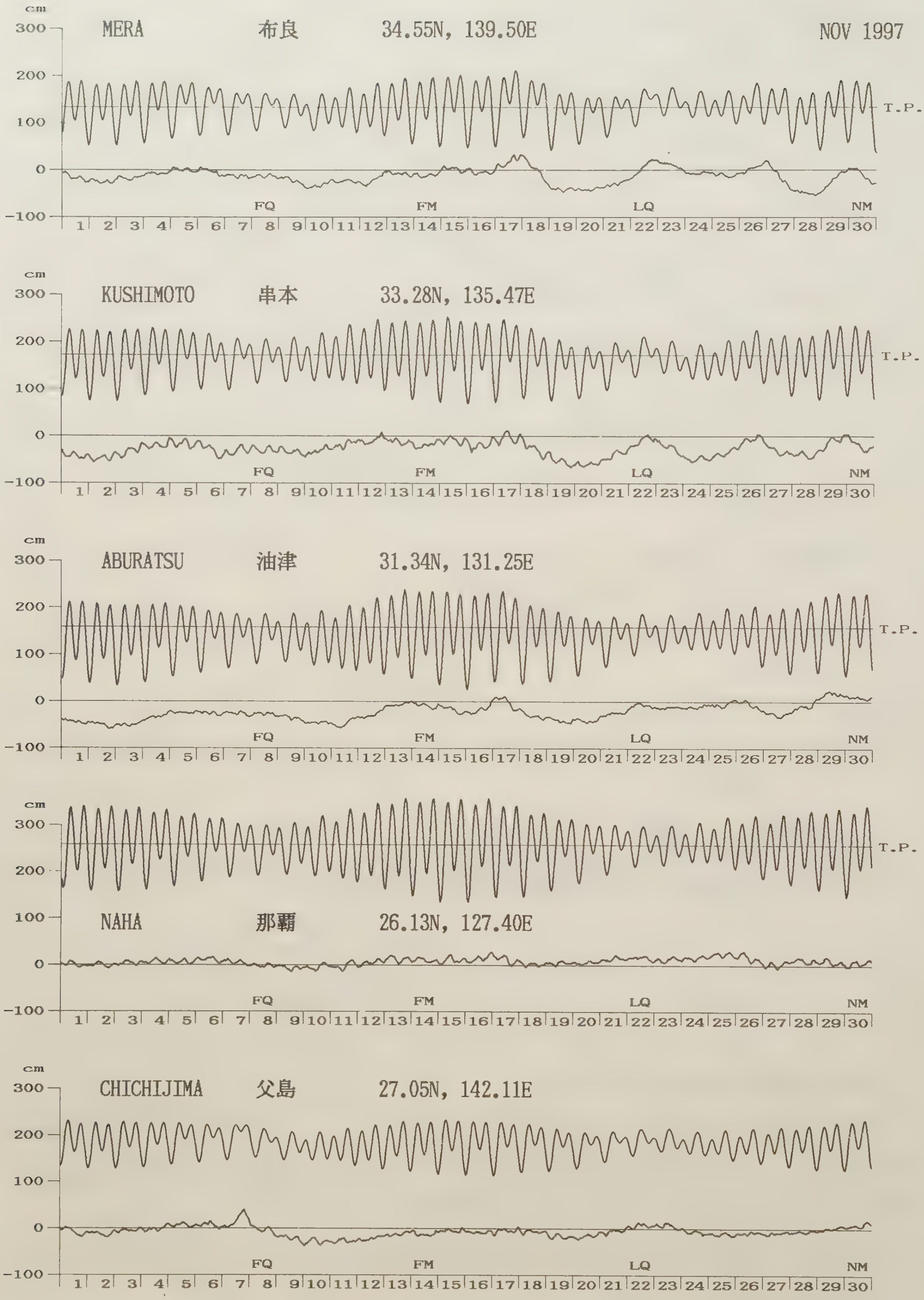




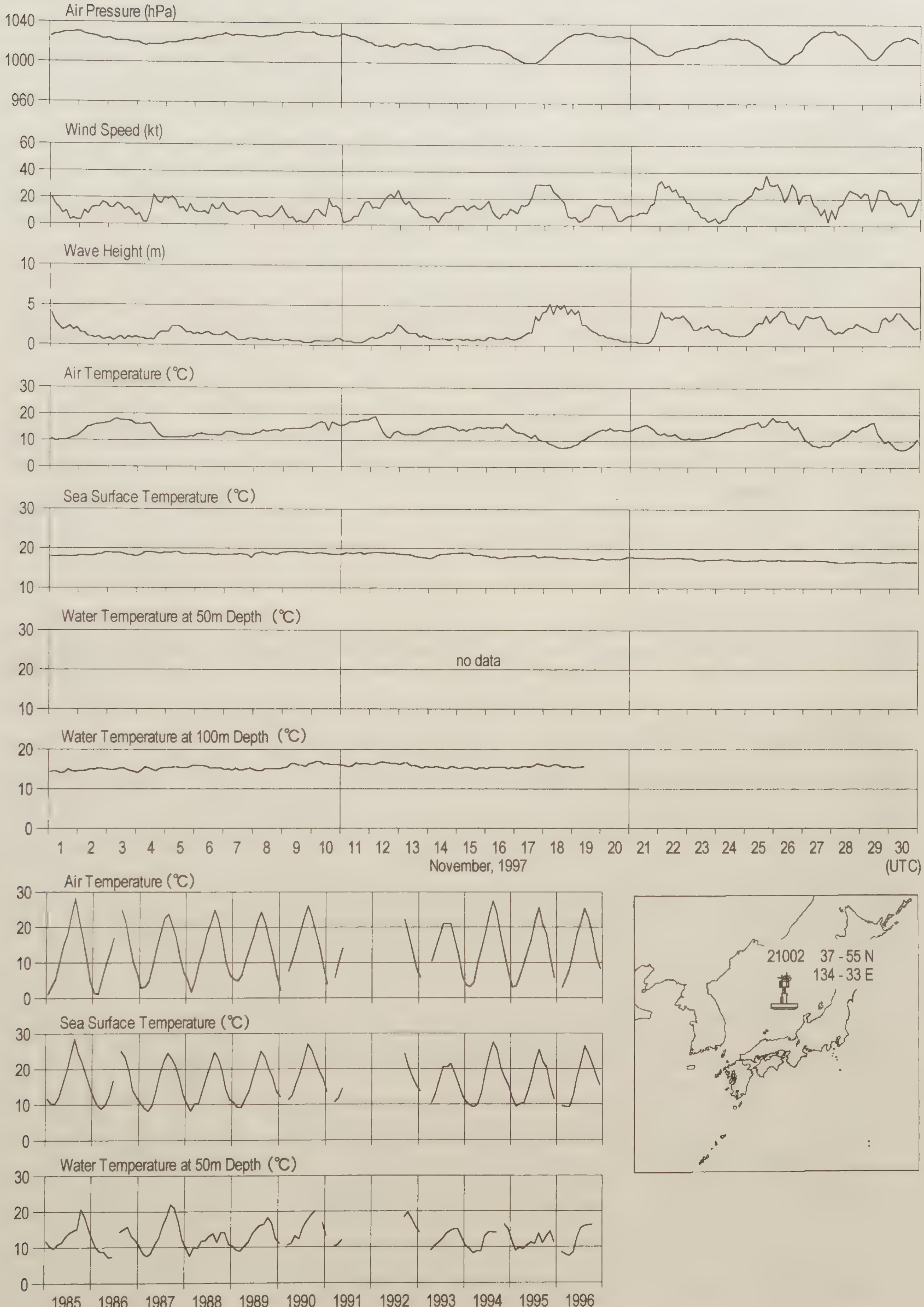


第14図 沿岸潮位時系列図（1997年11月）

Fig.14 Time series of hourly sea level observation (upper line) and its anomalies (lower line) at 9 stations of the JMA in the right panel.
Short term variations are removed from raw data.
Sea level anomalies are two times values of the differences between the observations and the predicted astronominal tide.
FM: full moon, FQ: first quarter
NM: new moon, LQ: last quarter
T.P.: Mean sea level of Tokyo Bay (Tokyo Peil)

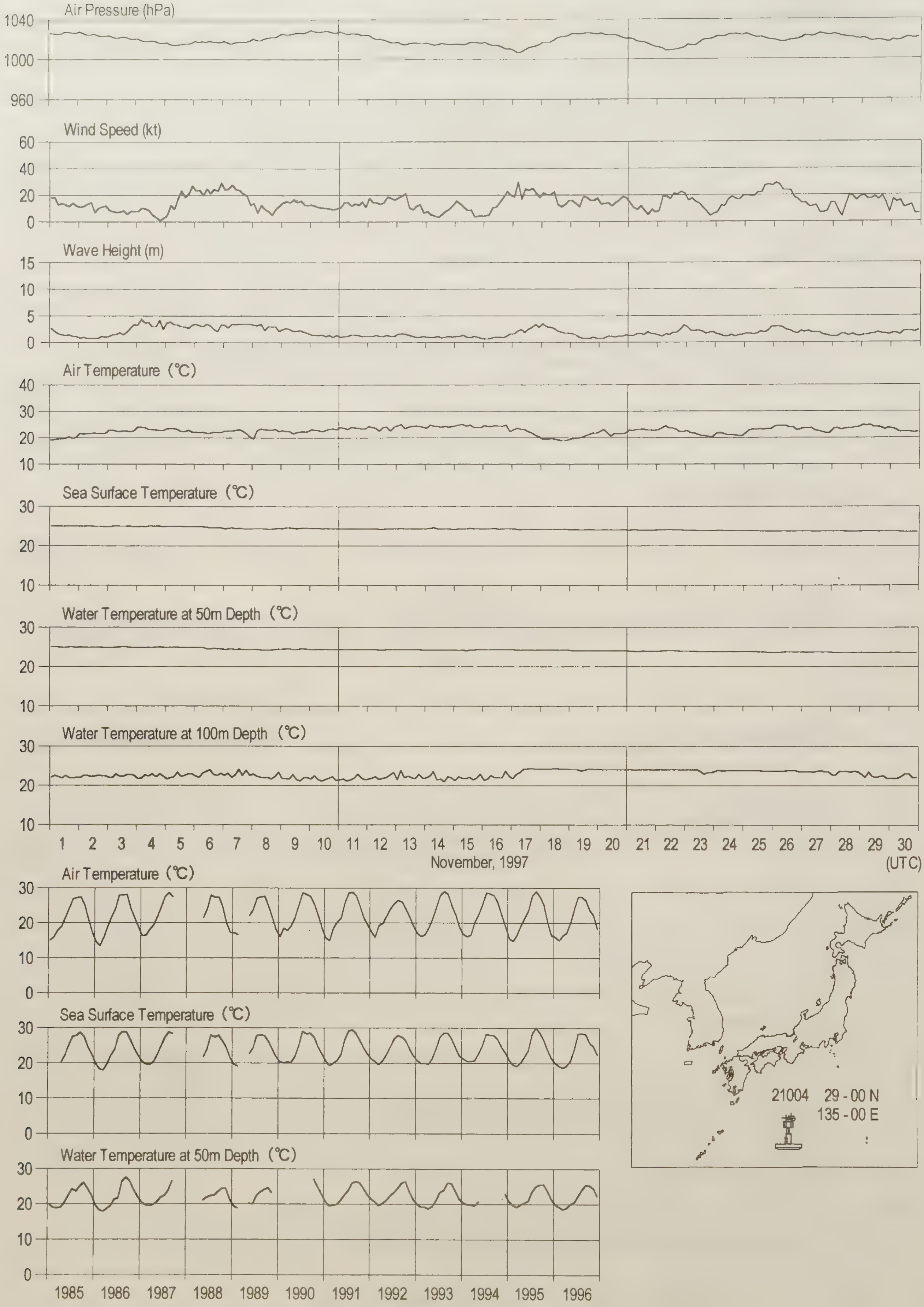


第14図 つづき
Fig.14 continue



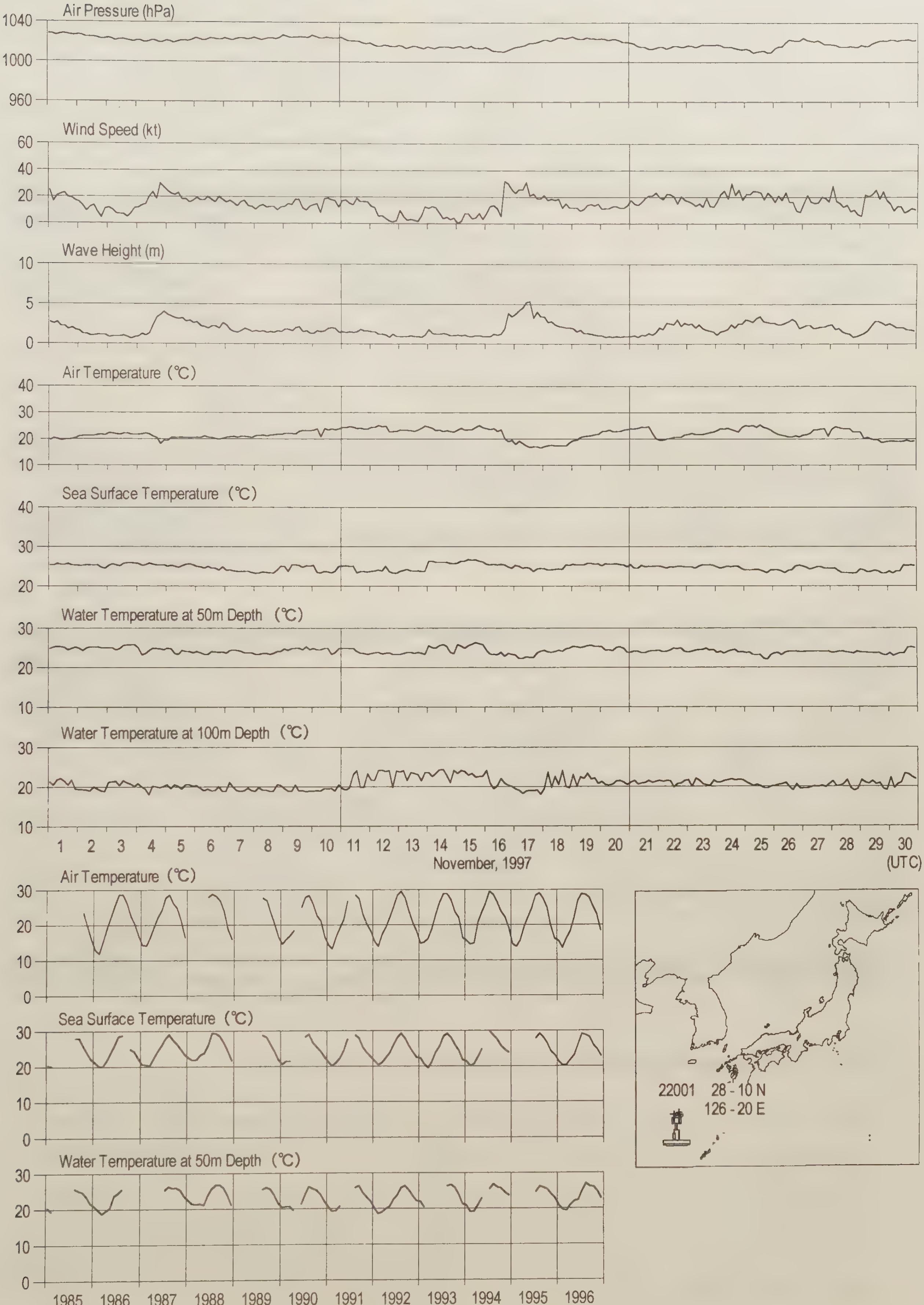
第15図　海洋気象ブイロボットによる観測要素の時系列図（日本海：21002）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation in the Japan Sea (WMO ID No. 21002).
The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



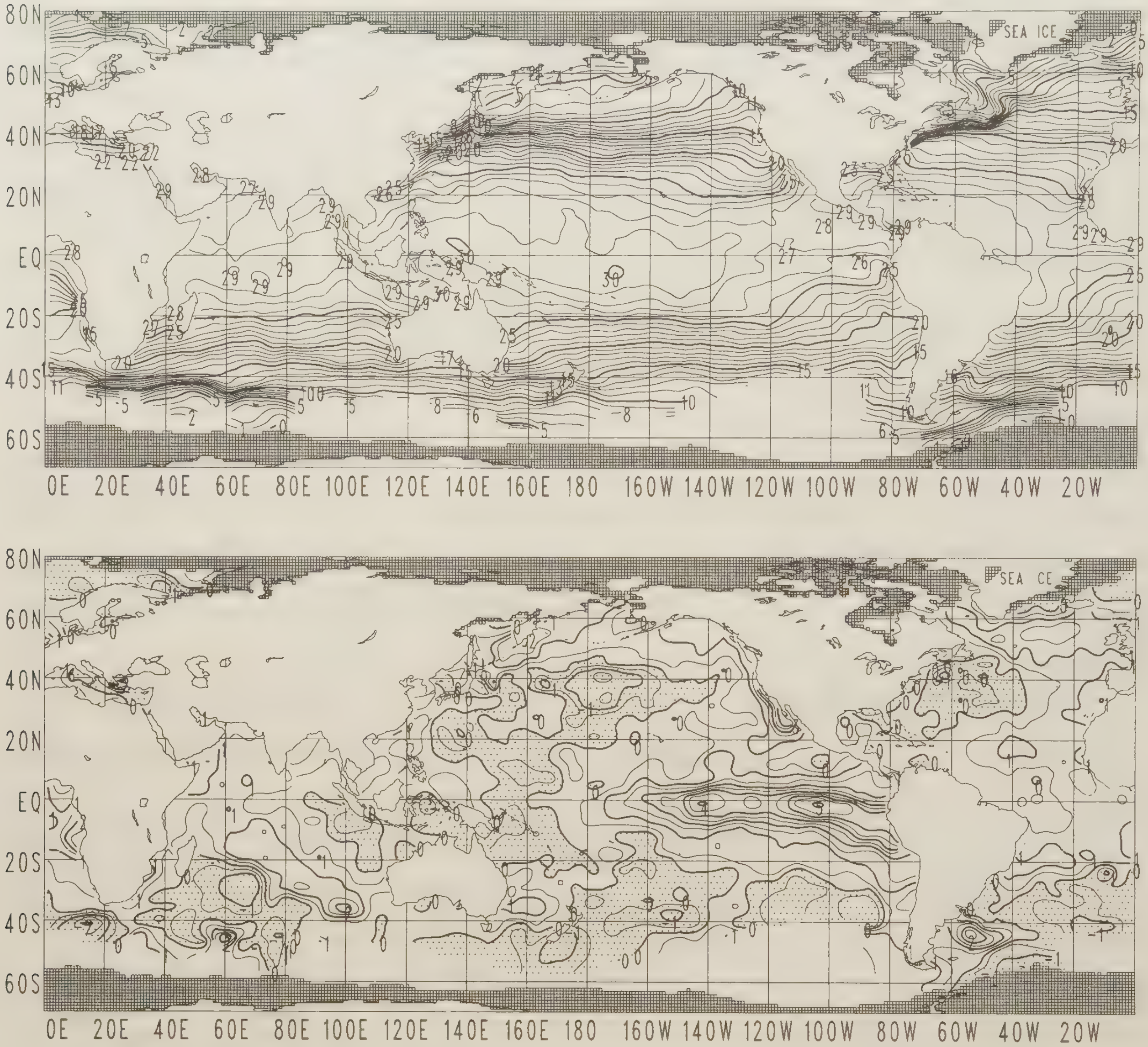
第15図　海洋気象ブイロボットによる観測要素の時系列図（四国沖：21004）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation south of Shikoku (WMO ID No. 21004). The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



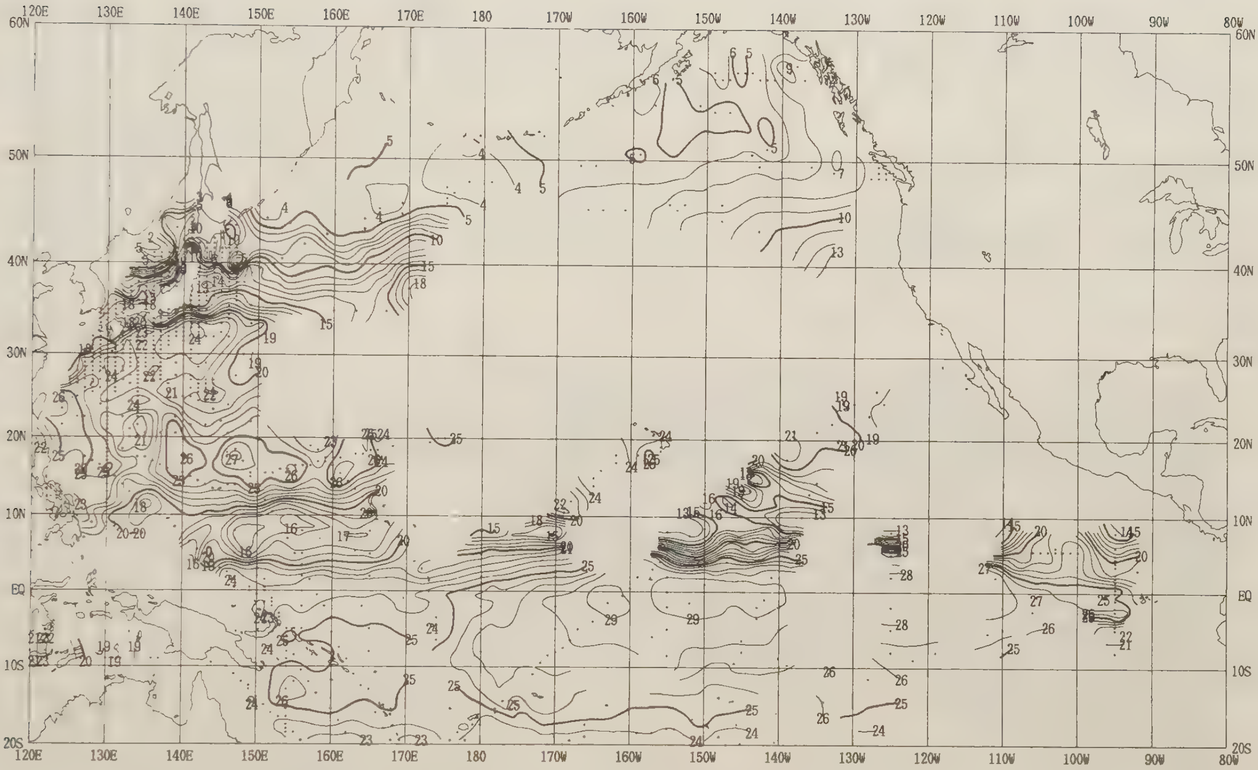
第15図　海洋気象ブイロボットによる観測要素の時系列図（東シナ海：22001）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation in the East China Sea (WMO ID No. 22001). The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



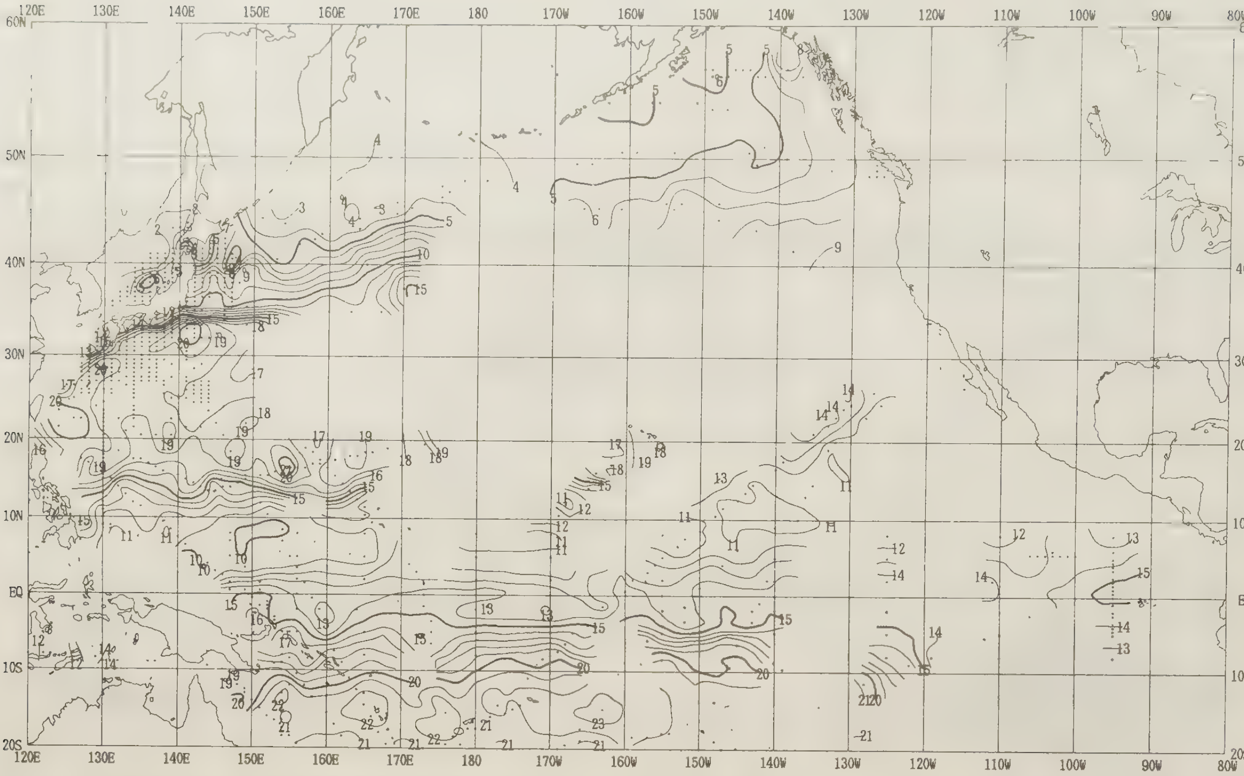
第16図　全球月平均海面水温図（上）及び偏差図（下）（1997年11月）

Fig.16　Monthly mean sea surface temperature over the global ocean (top) and anomalies (bottom) for NOV 1997.　Anomalies are computed from the JMA climatology (1961-1990). Contour interval is 1°C (top) and additional anomaly contours of ±0.5°C are shown by thin lines.　Negative anomalies are spotted.　Maximum coverage of sea ice is shaded.　Data sources for sea ice are U.S. National Ice Center (polar regions) and JMA (the Sea of Okhotsk).



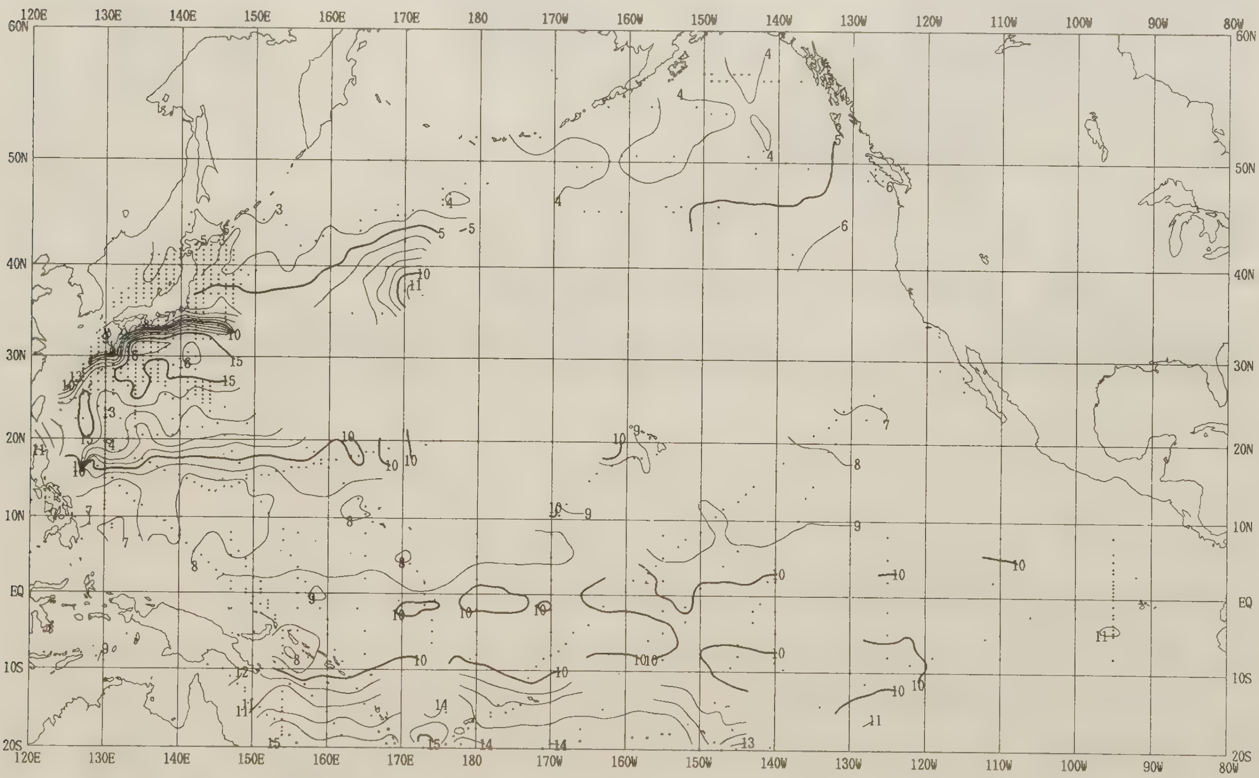
第17図　太平洋表層水温図(深さ100m)（1997年11月）

Fig.17 Subsurface (100m) temperatures in the Pacific Ocean for NOV 1997. Contour interval is 1°C. Observation points are denoted by dots.



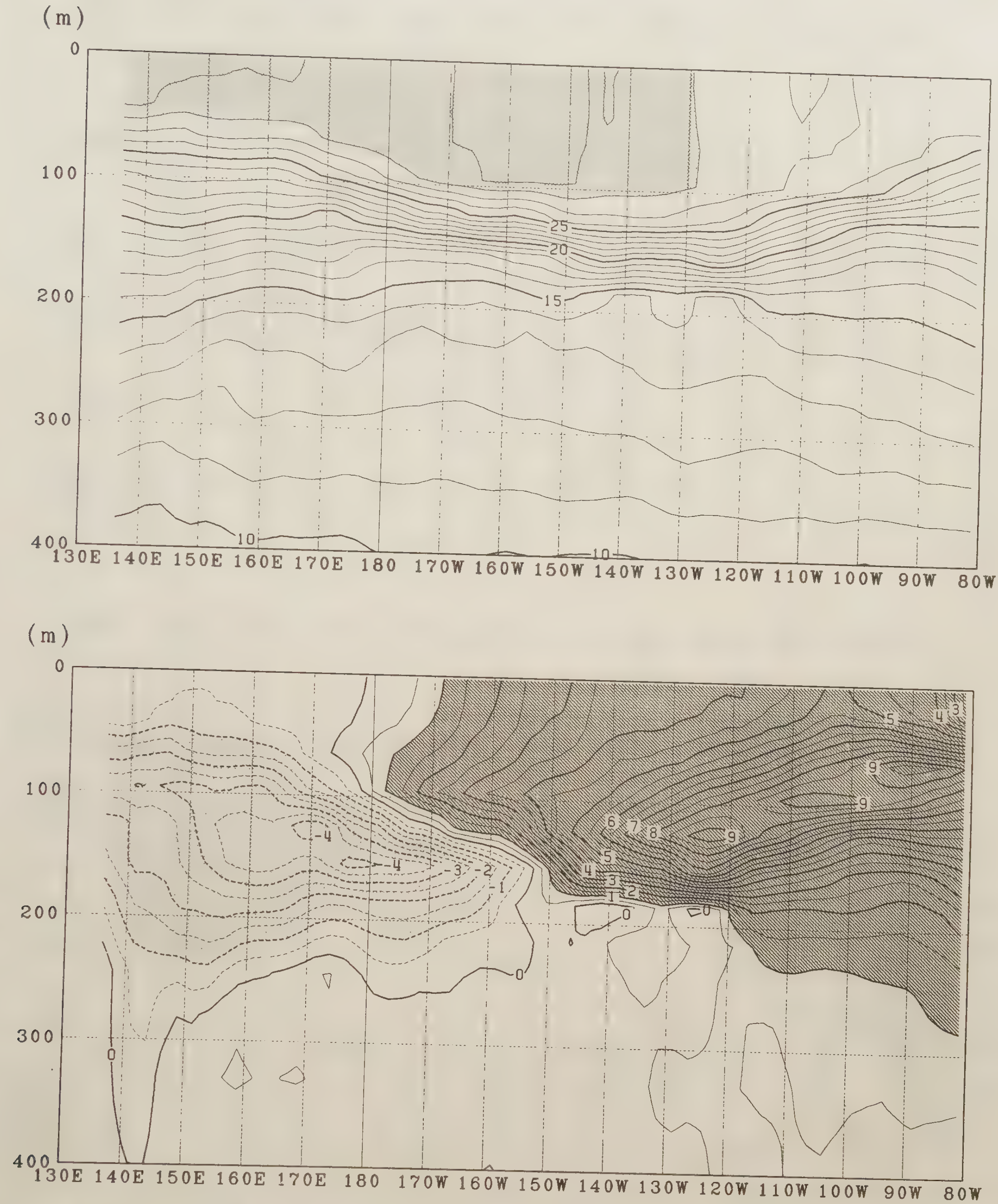
第18図　太平洋表層水温図(深さ200m)（1997年11月）

Fig.18 Subsurface (200m) temperatures in the Pacific Ocean for NOV 1997.
Contour interval is 1°C. Observation points are denoted by dots.



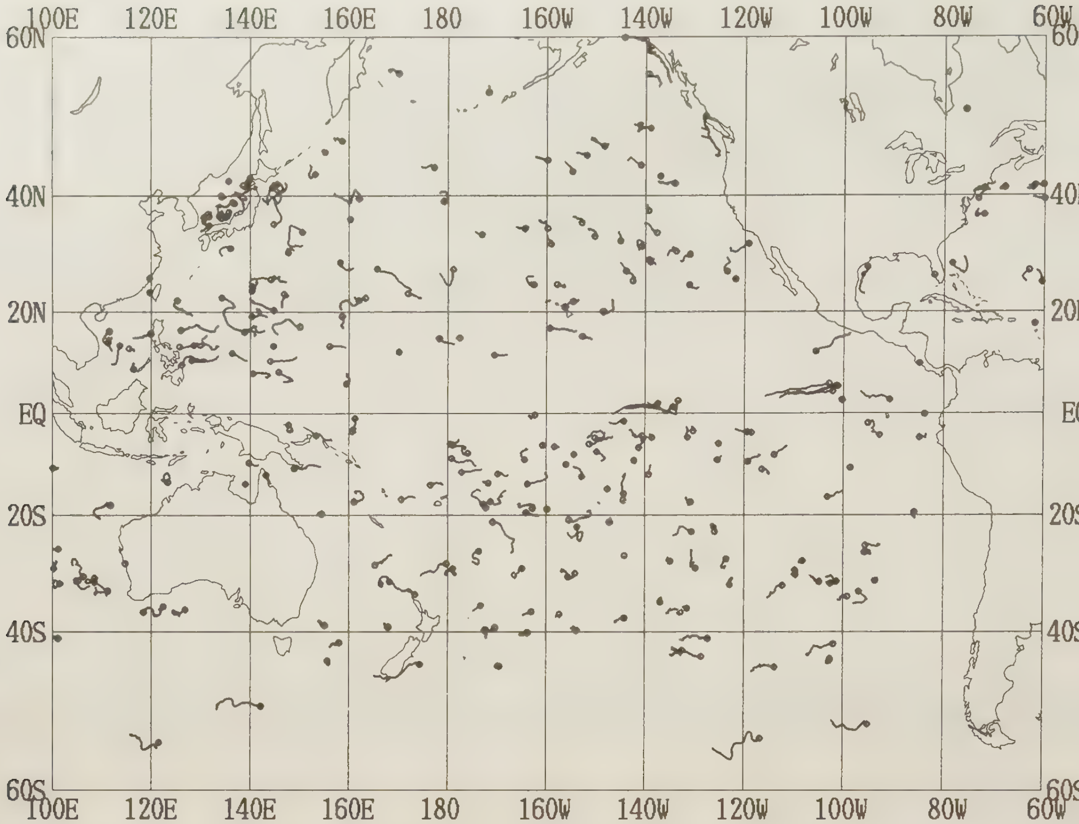
第19図　太平洋表層水温図(深さ400m)（1997年11月）

Fig.19 Subsurface (400m) temperatures in the Pacific Ocean for NOV 1997.
Contour interval is 1°C. Observation points are denoted by dots.



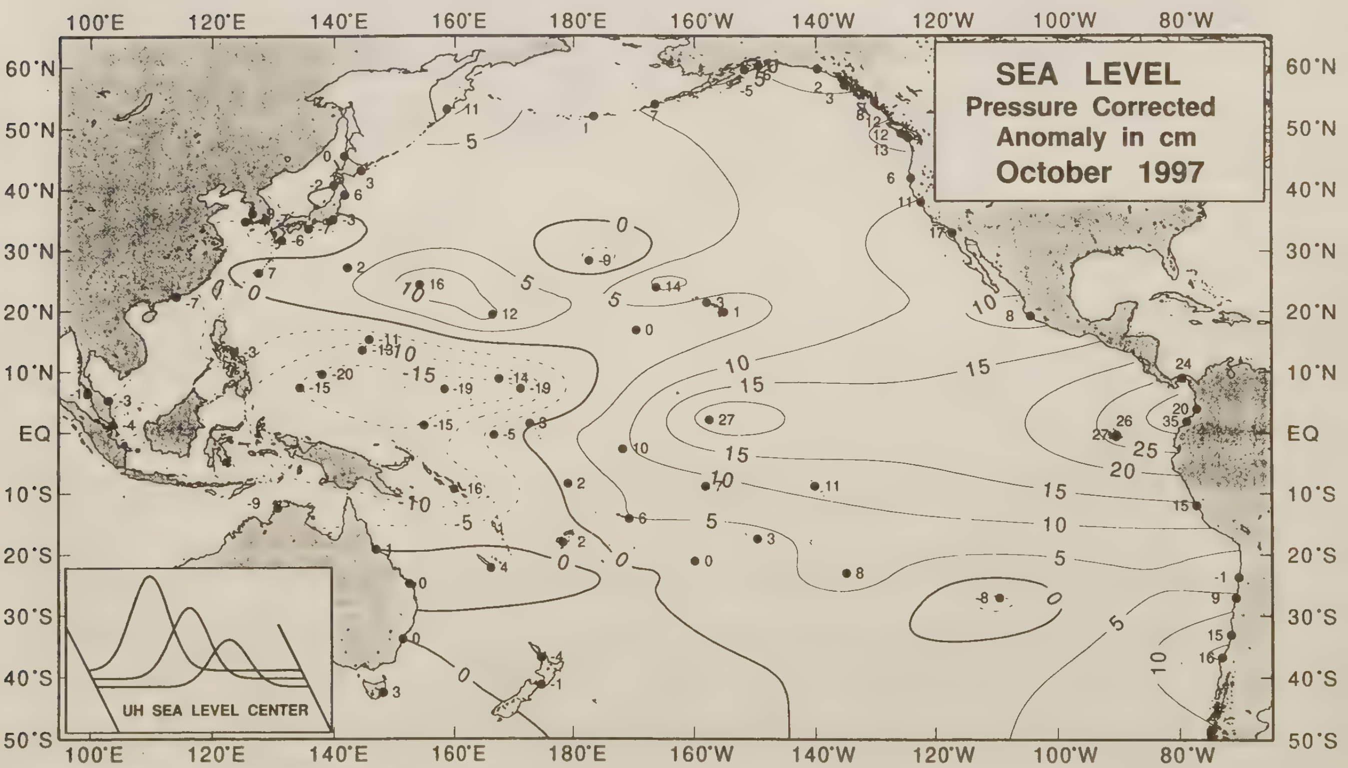
第20図　太平洋赤道に沿う表層水温（上）及び偏差（下）の深度－経度断面図（1997年11月）

Fig.20 Depth-longitude sections of temperature (top) and anomalies (bottom) along the equator in the Pacific Ocean for NOV 1997. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (top) and 0.5°C (bottom). Values greater than 28°C in the top panel are shaded. In the bottom panel, values greater than 1°C are shaded and values less than -1°C are spotted. Anomalies are computed from 1987-1996 base period means.



第21図　太平洋ブイ流跡図(1997年11月)

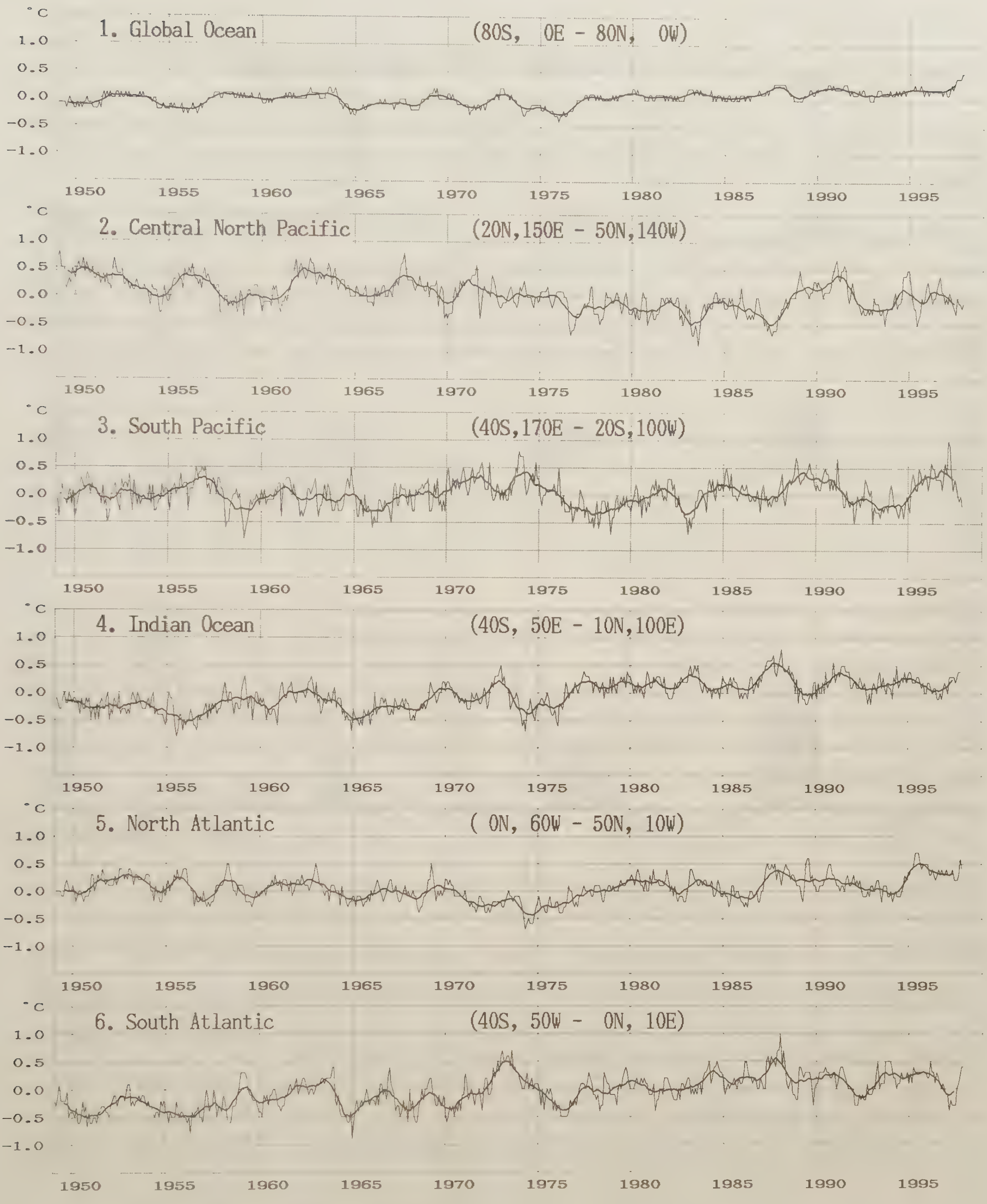
Fig.21 Movements of drifting buoys in the Pacific Ocean during NOV 1997.
Each track is for one buoy. Small circles represent last positions for the month.



第22図　太平洋海面水位偏差図 (1997年10月)

Fig.22 Monthly sea level anomalies for OCT 1997 obtained from mean sea level (1975-1995) adjusted for atmospheric pressure. This figure is prepared by the SOC of ISLP-PAC, Dept. of Oceanography, Univ. of Hawaii.

Long-term Variation of Monthly Mean SST Anomalies

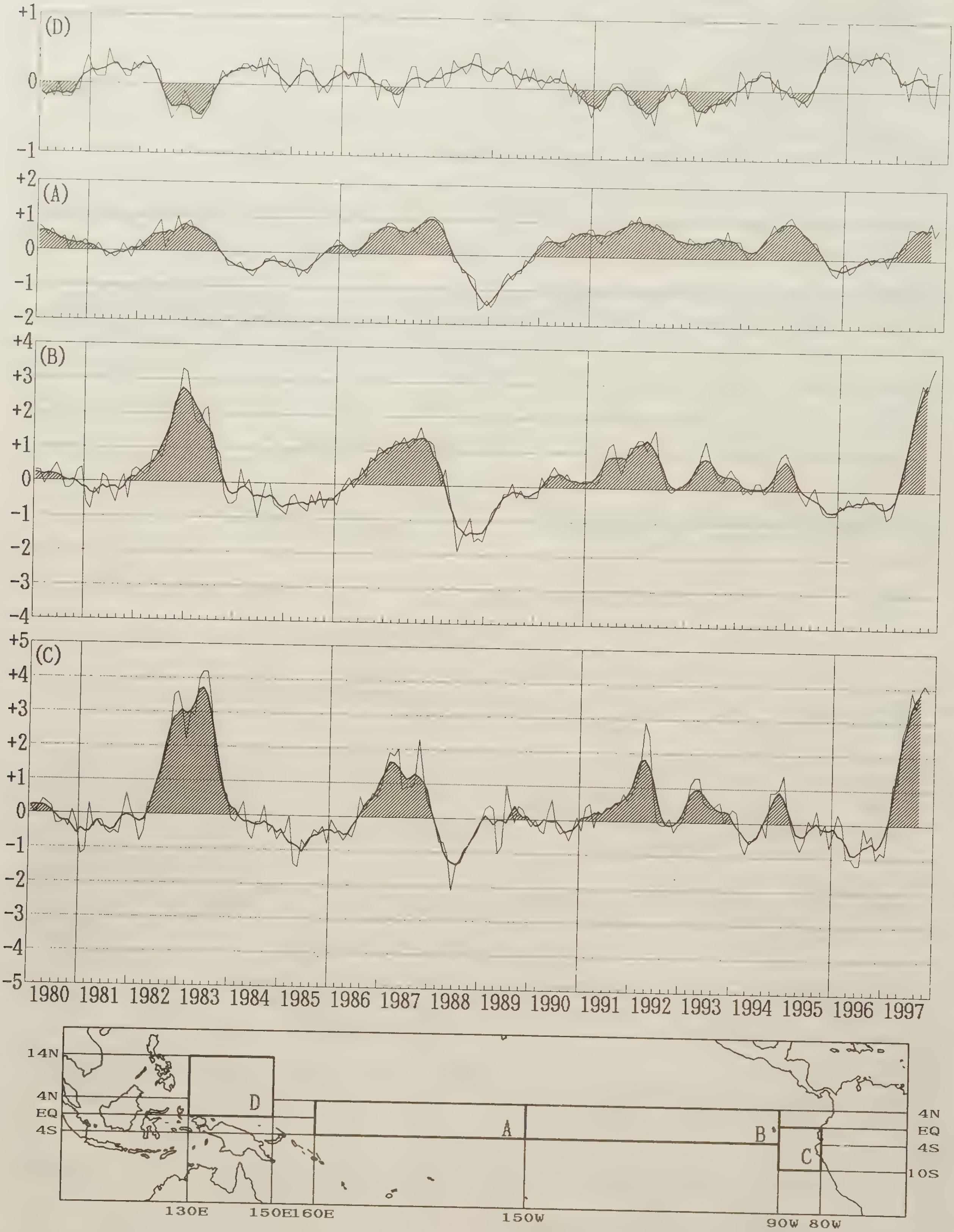




第23図 海域平均海面水温偏差の長期変動

Fig.23 Long-term variations of monthly mean sea surface temperature anomalies (°C) for the areas shown in the right panel. Anomalies are computed from the JMA climatology (1961-90). Thin lines show the monthly mean and thick lines their 13-month running means.

Time Series of Equatorial Pacific SST Anomalies



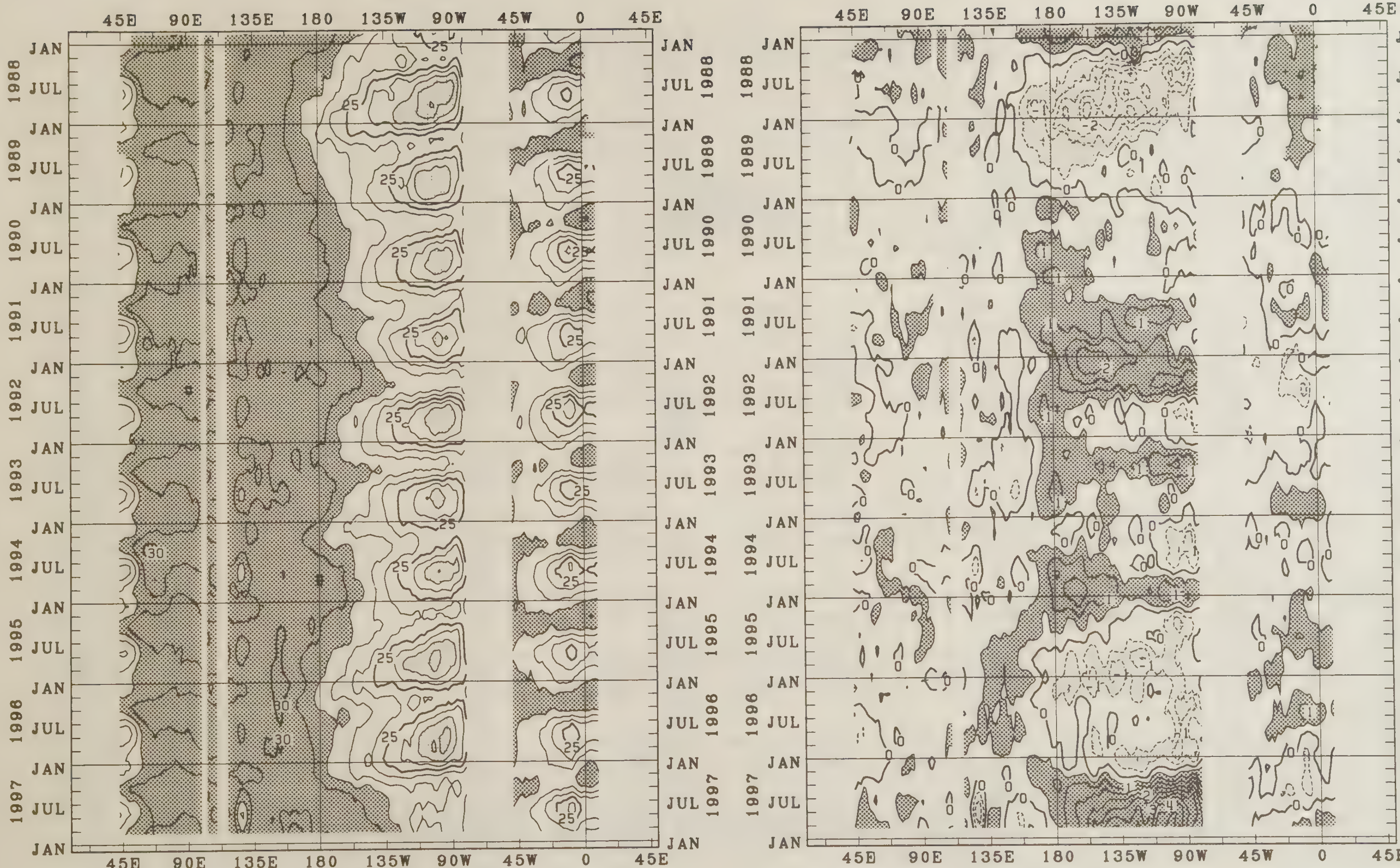
第24図　太平洋赤道域の海面水温偏差時系列図

Fig.24 Time series of monthly mean SST anomalies (°C) in the equatorial Pacific Ocean for the areas indicated at the bottom panel. Thin lines show the monthly means and thick lines their 5-month running means. Positive anomalies (A, B, C) and negative anomalies (D) are shaded. Anomalies are computed from the JMA climatology (1961-1990).

MONTH	SEA SURFACE TEMPERATURE AND ANOMALY (°C) REGION D 14N-EQ 130E-150E		REGION A 4N-4S 160E-150W		REGION B 4N-4S 150W-90W		REGION C EQ-10S 90W-80W		SOI	SEA LEVEL PRESSURE ANOMALY (hPa) TAHITI 17-33S 149-37W	DARWIN 12-24S 130-52E
JAN 95	28.3	-0.2	29.0	1.0	26.2	0.8	25.7	1.4	-0.4	-0.3	0.6
FEB 95	28.2	-0.1	28.9	0.9	26.8	0.6	26.1	0.4	-0.2	0.6	1.1
MAR 95	28.2	-0.2	28.8	0.7	26.9	0.0	25.8	-0.1	0.4	0.3	-0.5
APR 95	28.7	-0.1	28.8	0.6	26.9	-0.2	24.6	-0.5	-1.4	-1.6	-0.0
MAY 95	29.2	0.1	29.0	0.5	26.2	-0.4	23.1	-0.8	-1.0	-0.7	0.6
JUN 95	29.6	0.3	29.0	0.5	26.0	-0.1	22.2	-0.5	-0.1	0.3	0.4
JUL 95	29.5	0.3	28.7	0.2	25.3	0.1	21.7	0.1	0.4	0.4	-0.4
AUG 95	29.8	0.7	28.4	0.0	24.3	-0.3	20.5	-0.1	0.0	0.4	0.3
SEP 95	29.7	0.5	28.1	-0.2	24.0	-0.6	20.7	0.4	0.2	0.4	-0.0
OCT 95	29.8	0.5	28.0	-0.4	23.9	-0.7	20.4	-0.3	-0.3	-0.7	-0.5
NOV 95	29.7	0.5	27.9	-0.5	23.9	-0.7	21.5	0.0	0.1	0.1	-0.1
DEC 95	29.5	0.6	28.0	-0.2	24.2	-0.7	21.9	-0.7	-0.5	-0.9	0.0
JAN 96	29.0	0.5	27.9	-0.1	25.0	-0.4	24.1	-0.2	0.8	1.0	-0.7
FEB 96	28.6	0.3	27.6	-0.4	25.7	-0.5	26.0	0.3	0.1	-0.2	-0.5
MAR 96	28.8	0.4	27.8	-0.3	26.7	-0.2	25.9	0.0	0.7	1.0	-0.3
APR 96	29.3	0.5	28.1	-0.1	26.7	-0.4	24.1	-1.0	0.8	0.5	-0.5
MAY 96	29.6	0.5	28.5	0.0	26.2	-0.4	22.9	-1.0	0.3	1.2	1.2
JUN 96	29.7	0.4	28.6	0.1	25.7	-0.4	21.5	-1.2	1.4	1.6	-0.2
JUL 96	29.8	0.6	28.4	-0.1	25.1	-0.1	20.4	-1.2	0.7	0.6	-0.6
AUG 96	29.6	0.5	28.4	0.0	24.3	-0.3	20.5	-0.1	0.4	0.4	-0.3
SEP 96	29.8	0.6	28.4	0.1	24.3	-0.3	19.8	-0.5	0.5	-0.7	-1.7
OCT 96	29.9	0.6	28.5	0.1	24.3	-0.3	20.4	-0.3	0.4	-0.1	-0.8
NOV 96	29.5	0.3	28.2	-0.2	24.3	-0.3	20.5	-1.0	-0.0	-0.5	-0.5
DEC 96	29.2	0.3	28.3	0.1	24.1	-0.8	21.8	-0.8	0.8	-0.3	-1.9
JAN 97	28.6	0.1	28.3	0.3	24.7	-0.7	23.4	-0.9	0.3	1.7	0.9
FEB 97	28.5	0.2	28.2	0.2	25.9	-0.3	25.9	0.2	1.2	1.0	-1.9
MAR 97	28.3	-0.1	28.4	0.3	27.0	0.1	27.1	1.2	-0.6	-0.5	0.9
APR 97	29.0	0.2	29.1	0.9	27.5	0.4	26.3	1.2	-1.1	0.4	2.3
MAY 97	29.5	0.4	29.4	0.9	27.9	1.3	26.5	2.6	-2.5	-2.1	0.9
JUN 97	29.6	0.3	29.3	0.8	28.1	2.0	25.7	3.0	-2.3	-0.8	2.1
JUL 97	29.5	0.3	29.4	0.9	27.8	2.6	25.5	3.9	-0.8	-0.1	1.2
AUG 97	29.0	-0.1	29.2	0.8	27.7	3.1	24.0	3.4	-2.0	-0.9	2.2
SEP 97	29.0	-0.2	29.4	1.1	27.5	2.9	24.2	3.9	-1.4	0.1	2.7
OCT 97	29.6	0.3	29.1	0.7	27.9	3.3	24.8	4.1	-1.6	-0.2	2.7
NOV 97	29.5	0.3	29.3	0.9	28.2	3.6	25.4	3.9	-1.2	0.4	2.7

第1表　エルニーニョ監視指数

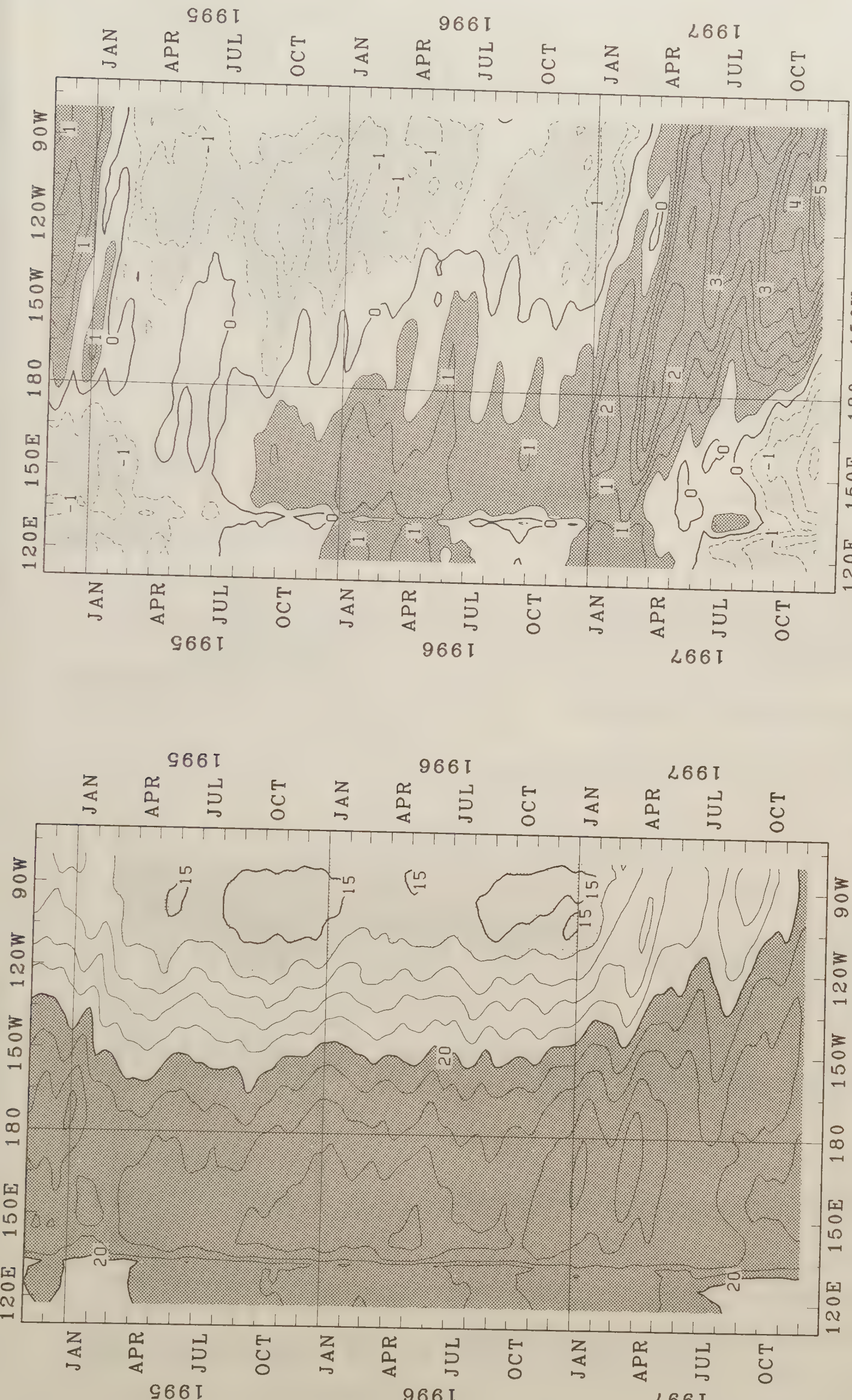
Table 1 El Nino Monitoring indices



第 25 図　赤道に沿った海面水温（左）および偏差（右）の時間-経度断面図

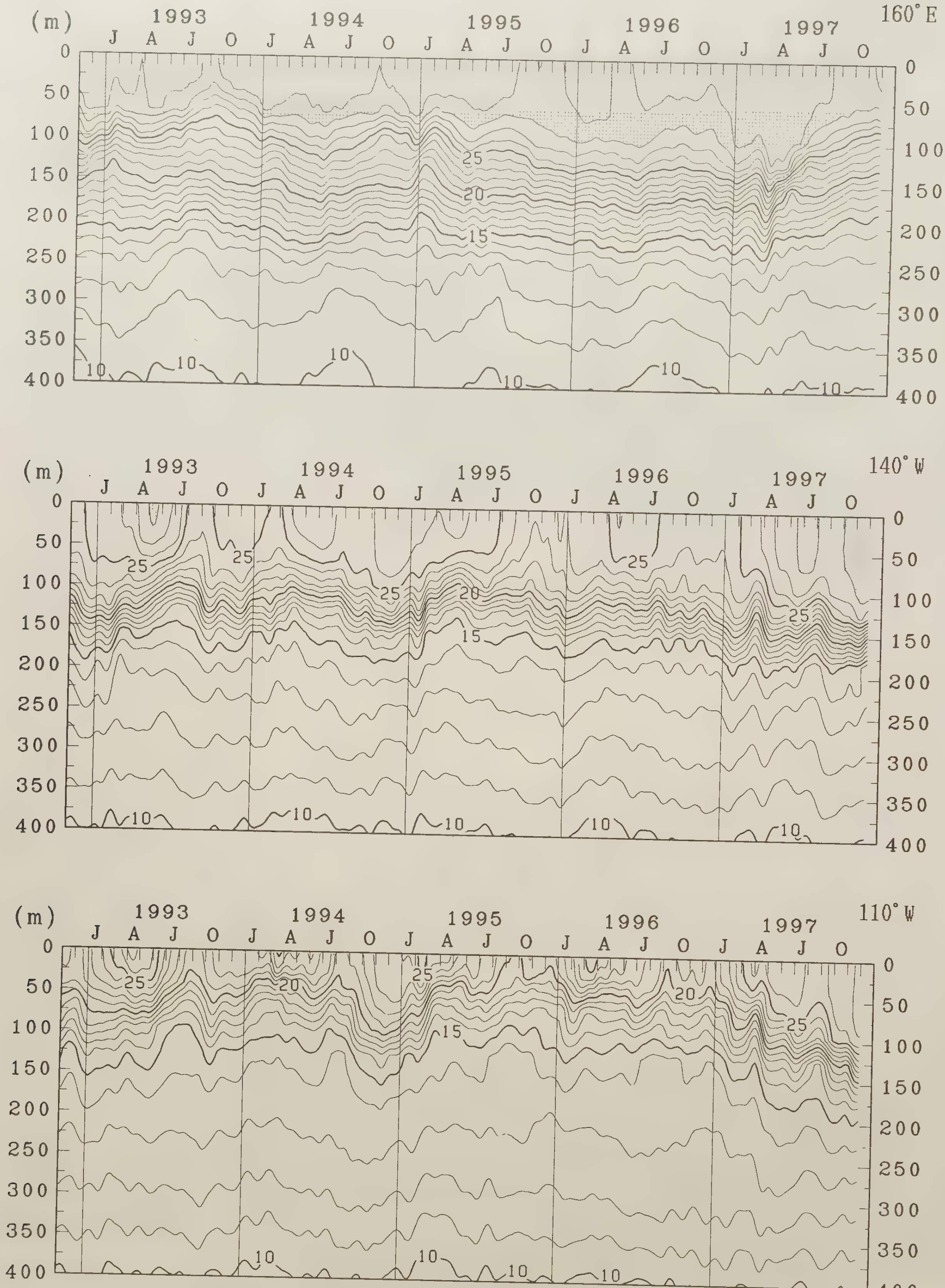
Fig.25 Time-longitude sections of SSTs (left) and anomalies (right) along the equator (2°N-2°S) in the global ocean. Contour interval is 1°C (left) and 0.5°C (right). Values greater than 28°C are shaded and values less than 23°C are spotted in the left panel. Dashed contours indicate negative anomalies in the right panel. Anomalies are computed from 1961-1990 base period means.

Time–Longitude Sections of Ocean Heat Content & Anomalies (Eq.)



第26図　太平洋の赤道に沿う海洋表層の貯熱量（左）及び偏差（右）の時間－経度断面図

Fig.26 Time-longitude sections of ocean heat content in the upper 260m along the equator (left) and anomalies (right) in the Pacific Ocean. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (left) and 0.5°C (right). Values greater than 20°C are shaded and values less than 16°C are spotted in the left panel. Dashed contours indicate negative anomalies in the right panel. Anomalies are computed from 1987-1996 base period means.



第27図　太平洋赤道域の表層水温の時間－深度断面図

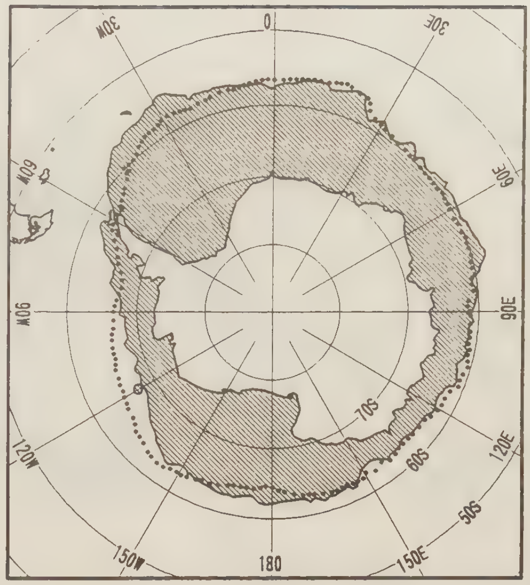
（上：西部、中：中部、下：東部）

Fig.27 Time-depth sections of equatorial subsurface temperature for the western Pacific (top, 160°E), the central Pacific (middle, 140°W) and the eastern Pacific (bottom, 110°W). Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C. Values greater than 28°C are shaded.



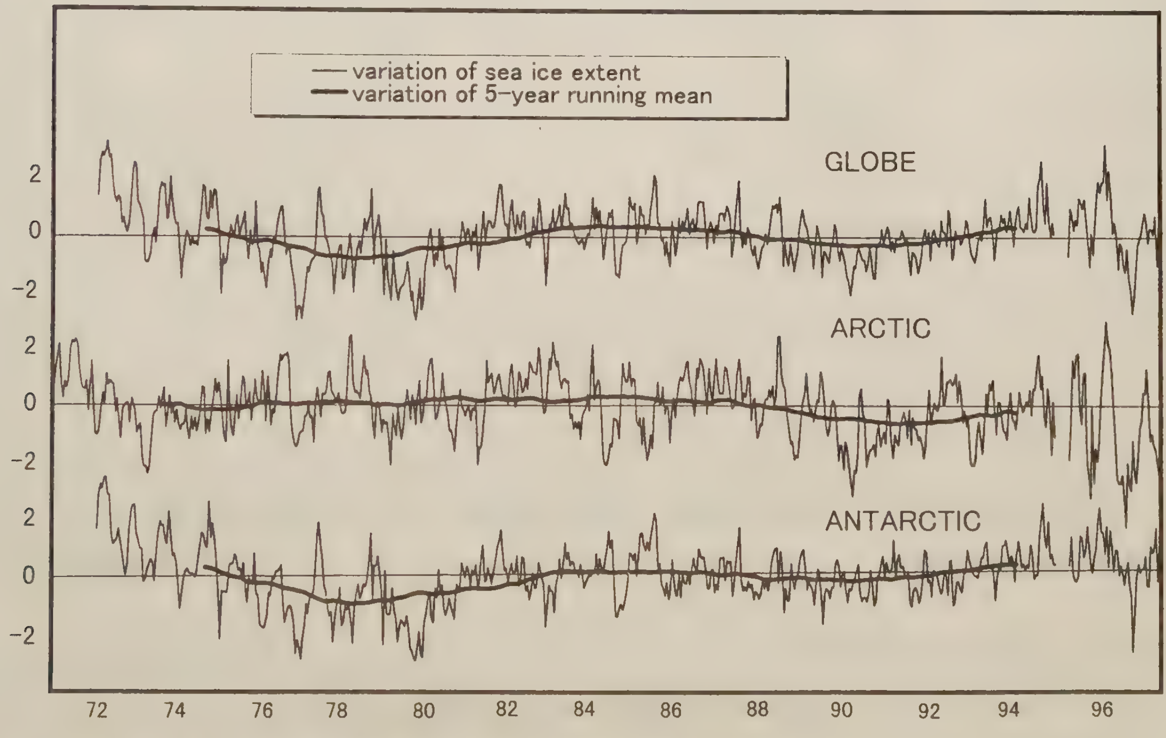
第28-1図 北極域の海氷図（1997年11月20日）

Fig.28-1 Sea ice chart in the Arctic on 20 Nov. 1997.
The shaded area represents the sea ice extent. The dotted line denotes the mean ice edge averaged for the period from 1972 through 1990.
The data source is the National Ice Center (USA).



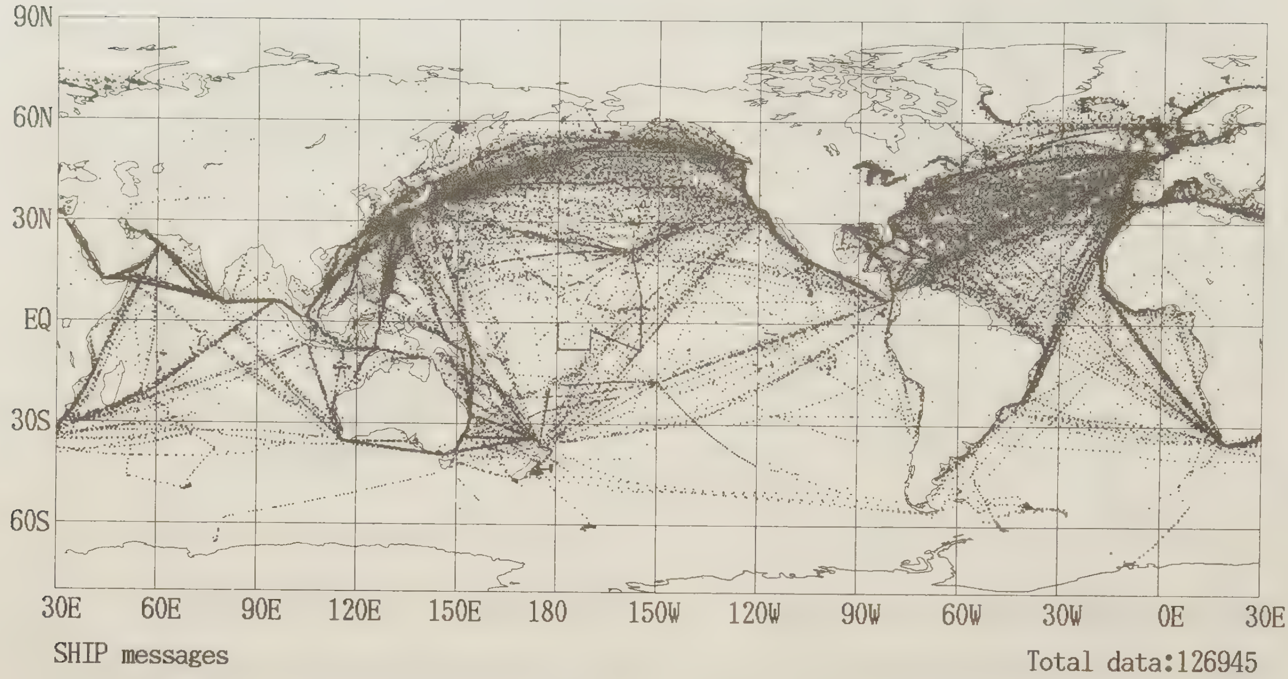
第28-2図 南極域の海氷図（1997年11月14日）

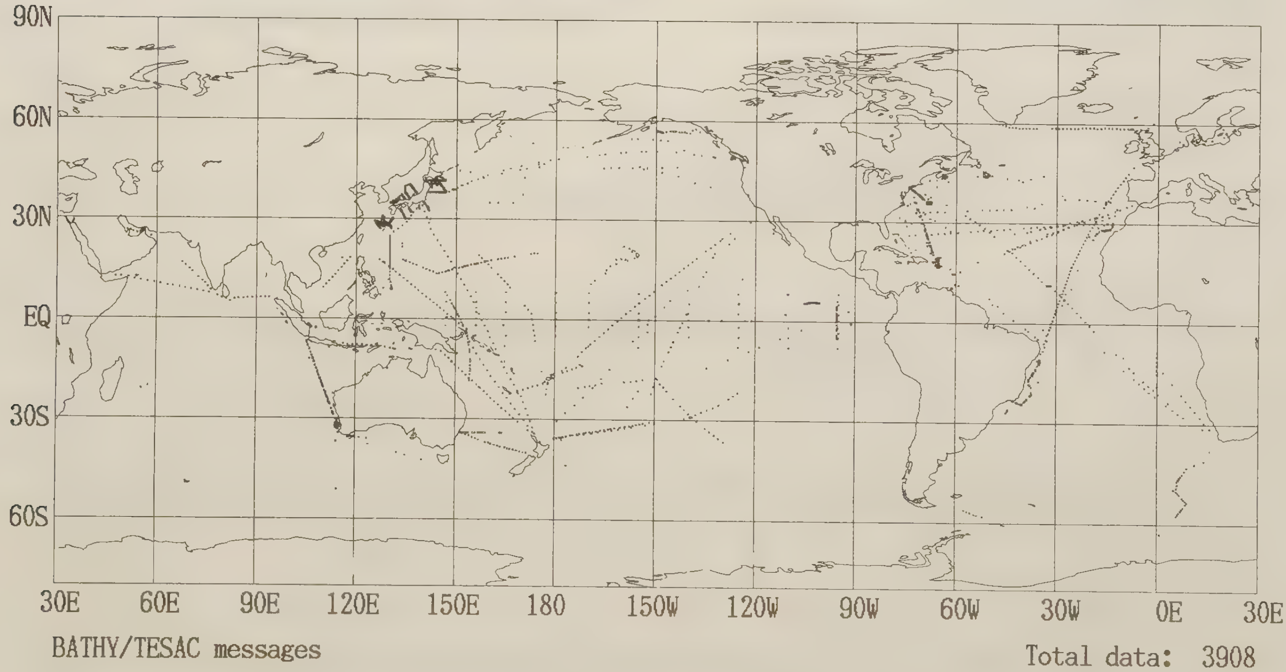
Fig.28-2 Sea ice chart in the Antarctic on 14 Nov. 1997.
The shaded area represents the sea ice extent. The dotted line denotes the mean ice edge averaged for the period from 1973 through 1990.
The data source is the National Ice Center (USA).



第28-3図　全球及び北極，南極における海氷域面積の平年偏差の時系列図
（縦軸の目盛りは標準偏差（全球80万km²，北極38万km²，南極87万km²）を表す）

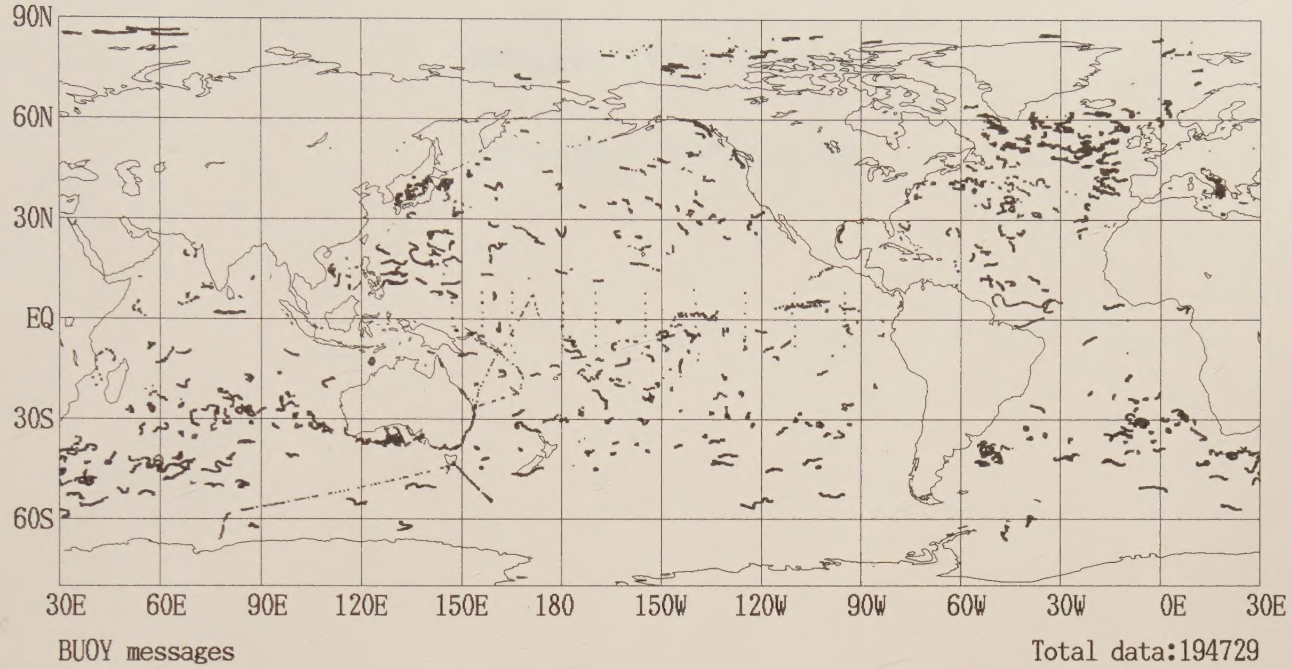
Fig.28-3　Time-series of the deviation of sea ice extent in the Globe, Arctic and Antarctic
(A scale of the vertical axis indicate standard diviation, that is, $80\times10^4km^2$ at the Globe, $38\times10^4km^2$ at the Arctic, $87\times10^4km^2$ at the Antarctic respectively)

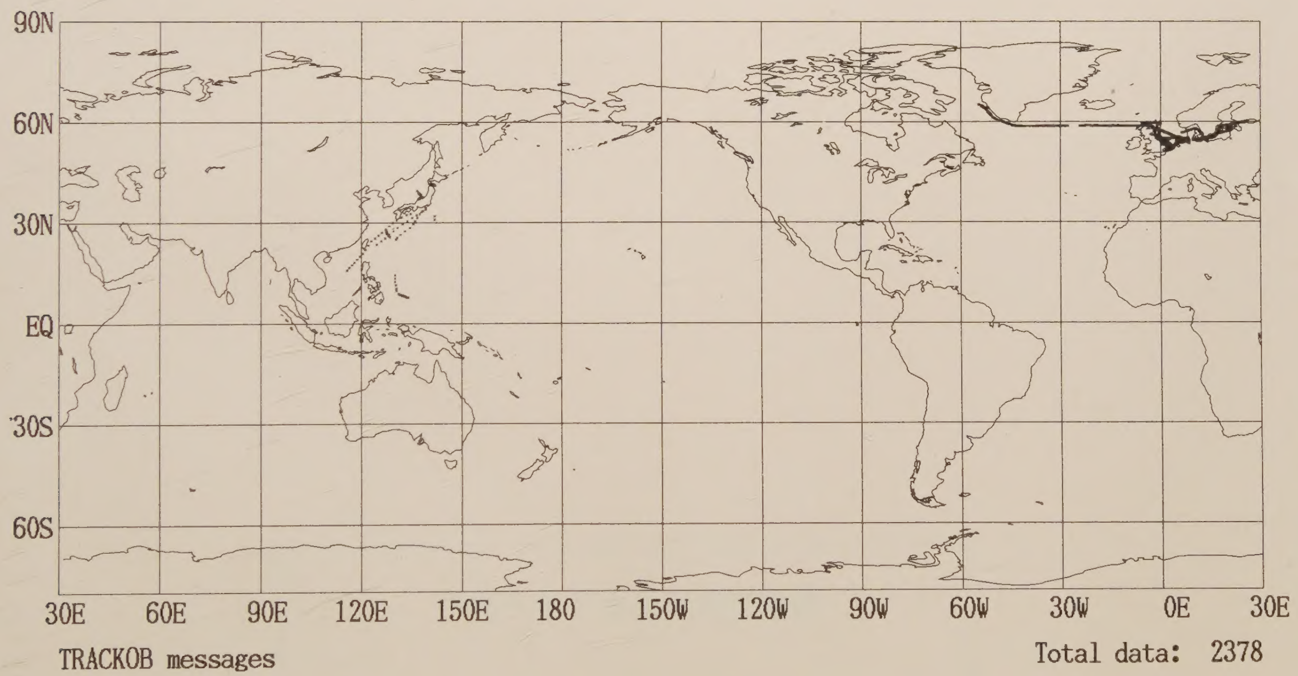




第29-1図　測点分布図(1997年11月)

Fig.29-1 Geographical distribution of SHIP messages (SST data, top) and BATHY/TESAC messages (subsurface temperature data, bottom) for NOV 1997.





第29-2図　測点分布図(1997年11月)

Fig.29-2 Geographical distribution of BUOY messages (buoy drift and SST data, top) and TRACKOB messages (ship drift and SST data, bottom) for NOV 1997.

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